BLACK BUTTE RESEARCH NATURAL AREA

Los Padres National Forest

San Luis Obispo County, California

DESCRIPTION, VEGETATION AND FLORA

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ABSTRACT

The vegetation and flora of the proposed Black Butte Research Natural Area in Los Padres National Forest, San Luis Obispo County, was studied over a three year period from 1993-1995. The study site is in the northernmost part of the Santa Lucia Wilderness Area and covers 540 acres (~218 ha), encompassing elevations ranging from 2742 ft (844 m) to 1400 ft. (431 m). The site parent materials are composed of faulted and variably tilted marine shales of Miocene age (Monterey formation). The climate is Mediterranean, and the site is located on a ridge which serves to sharply delimit equable, coastal climates from the more arid, temperate interior. Plant associations present are knobcone pine forest, intergrading chamise and interior live oak chaparral, coast live oak woodland and mixed evergreen forest. These associations are described and mapped. Pre- and post-1994 Morro Fire vegetation and floristic observations are quantified and summarized. 207 vascular plant taxa are documented from the site; 4 others are likely also present for a total of 211. The distribution and variation within and among these taxa are discussed where appropriate. Three plant taxa of limited distribution are present: *Arctostaphylos luciana* P. Wells (Santa Lucia manzanita), *Agrostis hooveri* Sw. (Hoover's bentgrass) and *Calochortus clavatus* S. Watson ssp. *clavatus* (Club-haired mariposa lily). Their distributions within the study area are discussed and mapped. A checklist and identification keys to genera and species observed within the study site are provided.

SITE DESCRIPTION

The proposed Black Butte Research Natural Area (referred to hereafter as BBRNA) covers approximately 540 acres (~218 hectares) northeast of the city of San Luis Obispo, San Luis Obispo County, California (figure 1). The site includes the northernmost roadless and trail-less parts of the Santa Lucia Wilderness Area within the Los Padres National Forest (figure 2). Elevation ranges from 2742 ft. (844 m.) on the highest peak approximately 1 mile (1.6 km.) east of Mt. Lowe to 1400 ft (431 m.) in the main canyon near the BBRNA east boundary. These elevation ranges are accomplished in short distances, and slopes of 80% or more are common within the BBRNA. The primary west-southwest facing ridge has an elevation range of 2080 ft. (640 m.) to 2570 ft (791 m.) at Mt. Lowe. This ridge thus forms a major topographic boundary between the western maritime-influenced climatic region and the temperate interior. In addition, the east-trending ridge between Mt. Lowe and the unnamed peak at 2742 ft. separates the BBRNA drainage from the larger Lopez Canyon drainage which feeds Lopez Reservoir about 12 miles (20 km.) to the south. Drainage within the BBRNA is eastward, encompassing a natural and contained watershed flowing into Trout Creek near its confluence with Water Canyon, and ultimately the northwestward flowing Salinas River. Thus, the ridge between Mt. Lowe and the peak at el. 2742, is a natural divide between two major drainages; one flowing southwest (Lopez Canyon) and one flowing northwest (Salinas River). The streams within the BBRNA are for the most part intermittent, but at least two permanent springs occur in one canyon bottom (see figure 3) and water is often present for the entire season in portions of the lowermost stream beds. These streams are unnamed, but may be considered the western fork of Trout Creek.

The site supports a complex mosaic of variable vegetation types. Included are extensive stands of *Pinus attenuata* (knobcone pine); variable forms of chaparral including areas dominated by the narrow

endemic *Arctostaphylos luciana* (Santa Lucia manzanita), and woodlands dominated by *Quercus agrifolia* (coast live oak). In addition, relictual stands of *Lithocarpus densiflora* (tanoak) occur in mesic, mixed woodlands dominated by *Quercus chrysolepis* (canyon live oak), and which also contain significant proportions of *Arbutus menziesii* (madrone) and *Umbellularia californica* (California bay). Finally, scattered individuals of *Pinus coulteri* (Coulter pine) occur primarily where ecotonal sites between chaparral and the forest containing *Lithocarpus* et al. are juxtaposed upon steeply dipping rock outcrops. The Coulter pine trees are thus protected to some extent from fire. Weakly developed riparian habitats are present in the bottoms of the two unnamed streams which drain eastward from below Mt. Lowe; however, the extent and development of riparian habitat is limited and thus is not mapped nor discussed separately in this report.

The underlying parent material of the BBRNA is the Monterey shale formation, a moderately acidic, siliceous marine shale of Miocene age (20-7 mybp). The vegetation appears influenced not so much by the parent material type, but instead by both the relative surface position of the faulted and tilted shale layers which appear as a complex network of vertical, diagonal and horizontal strata, and by topographic position, i.e. top, side, or base of slopes.

Three special-status plant species are present; the aforementioned *Arctostaphylos luciana*, whose known populations are to a large extent included within the BBRNA; *Agrostis hooveri* (Hoover's bentgrass), an endemic of San Luis Obispo and Santa Barbara Counties with a single population in the BBRNA; and *Calochortus clavatus* var. *clavatus*, a plant more common on serpentine northwest of Cuesta Pass, but which nevertheless grows on Monterey shale in one locality within the BBRNA. Of interest in terms of botanical history are the large stands of *Lotus crassifolius* present on several BBRNA ridgetops. This species had been listed for San Luis Obispo County by Hoover (1970) but its presence was based upon a single decades old collection and the exact location (if present) was unknown in 1970. This extended population may be the only known in San Luis Obispo County.

PHYSICAL DESCRIPTION

Black Butte RNA is 3-3.5 miles (4.9-5.7 km.) south-southeast of the summit of Cuesta Pass on US 101. The area was described by Hoover as "southeast of Cuesta Pass" and is so cited in the 'Vascular Plants of San Luis Obispo County' (Hoover op. cit.). Black Butte RNA may be reached by traveling US Highway 101 either ~4.5 miles (7.3 km.) north from San Luis Obispo, or ~19 miles (30.9 km) south from Paso Robles. It is accessed from Forest Service Road 30S11 heading south from the summit of Cuesta Pass. When traveling north along US 101, a truck/telephone pullout provides a safe and convenient exit from the freeway, but this turnout is inaccessible from the southbound lanes. The safest route traveling south is to continue past Cuesta Pass, turn around in San Luis Obispo, then return heading north. Road 30S11 is well-maintained due to its use as access to Pacific Gas and Electric relay stations on the summit of Mt. Lowe and the peak immediately north. Road 30S11 has a locked gate at US 101 (visible on the San Luis Obispo 7.5' quadrangle), but passage is allowed on foot (using road 30S11) through the private land separating the National Forest administered territory from the road 30S11 gate. Forest service jurisdiction, and the BBRNA, begins approximately 3 miles southeast of Cuesta summit along 30S11. It is only a few minutes drive by vehicle from the US 101 gate; it is about a 3/4-1 hours uphill walk to the BBRNA from US 101. The National Forest

boundary is well-marked on the ground (a sign and cattle guard) and is visible on the Lopez Mtn. 7.5' quadrangle. The boundaries of the BBRNA at the 7.5' scale are presented in figure 3. There are no other roads within or accessing the BBRNA, but a firebreak extends along the ridge heading east from the summit of Mt. Lowe (plate 1 and see figure A, Appendix I). Spur roads access the microwave towers on both this summit and the summit of the peak immediately north.

Although the BBRNA is included within the Santa Lucia Wilderness Area, there are no maintained or unmaintained trails within it. Access is by animal trails only; even hunters find the area too rugged to have established access into its interior. Within the BBRNA, dense chaparral, thick woodland understory, and extremely steep slopes hinder entrance and movement. Summer temperatures are high, and water availability is restricted to the bottom of the main canyon below Mt. Lowe, where two permanent springs surface (see figure A, Appendix I).

Adjacent land is in both private ownership and under Forest Service control. The land immediately north of the BBRNA through which the access road passes is in private ownership, but easements exist to allow passage to the National Forest and microwave towers. The land to the immediate east is also in private ownership. Access into the lowermost canyons, for official research purposes, could be possible through this latter property, but require both permission, and a long roundabout drive from Santa Margarita east of US 101 and north of Cuesta ridge.

REGIONAL DESCRIPTION AND CLIMATIC EFFECTS

The high ridge forming the west-southwest-facing boundary of the BBRNA (see figure 3) is the southernmost extension of a generally southward trending fault-block extending from approximately Monterey to Cuyama Canyon on the Santa Barbara County north boundary. These are the Santa Lucia Mountains, with the BBRNA situated near the southern end of this mountain chain. This mountain ridge in San Luis Obispo County is referred to as Cuesta Ridge; it has a steep west face with short steep canyons draining generally westward. The east side has longer eastward draining canyons, with steep intervening ridges. The range in this region is narrow, approximately 1-2 miles wide. However, the ridge has distinctive effects on the climate of the region, acting to block summer maritime fog, cool maritime air and winter precipitation from the interior. Thus the flora and vegetation of the area interior to this ridge are different from those of the west side. While winter frosts are common on the ridge's east side, they are decidedly uncommon on the west.

The proposed Black Butte RNA is situated along the immediate ridge summit, extending across its entire width, with the eastern terminus close to the margin of the upper Salinas River Valley. Thus, there is considerable potential for differential adaptation among the plants found within the BBRNA. These adaptations could result from the contact of differently adapted genotypes within or among closely related taxa or among ecotypes found on both sides of Cuesta Ridge. Because of the extremely difficult access, the northern part of the Santa Lucia Wilderness (i.e. the Black Butte RNA) is poorly known biologically. However, it is this condition that makes it a good candidate for a research site. Access to its western edge is possible by any type of vehicle, and it is safe to leave the vehicle parked as access to the road is restricted. Equipment placed within the BBRNA will unlikely be disturbed. The steep slopes and dense vegetation have discouraged livestock grazing, and its current status as Wilderness precludes further commercial exploitation. Although still relatively unvisited,

the human presence on road 30S11 has increased in the recent past; vehicles and equipment should at least be locked when unattended.

CLIMATE

Temperature and precipitation patterns characterizing Black Butte RNA are those typical of central California Mediterranean climates with a mild, moist cool-season (winter), followed by a long, dry, warm-season (summer). Within this climatic type, summer water stress and the range of yearly temperature fluctuation are primary determinants of biological composition. Data are not available to plot summer water deficit at the BBRNA in relation to the nearby region. Concerning precipitation within the BBRNA, it can be said that the high ridge forming the western boundary intercepts cool-season cyclonic low pressure, resulting in increased precipitation along the ridge and its immediate lee, with a sharp diminishment of same inland. Data for yearly temperature averages and means for the warmest and coldest months are available. These characteristics of climate are influenced by proximity to the oceanic heat sink (i.e. Pacific Ocean).

Weather data were acquired from yearly summaries published by the United States National Weather Service. Weather stations which record temperature maxima and minima are located at San Luis Obispo, California Polytechnic State University [weather station #7851, Central Coast Drainage, elev. 300 ft.(92 m), 35°18'N, 120°40'W], on the western side of the Cuesta Ridge approximately 3 air miles west of the BBRNA, and at Paso Robles [weather station #6730, Salinas Valley Drainage, elev. 995 ft. (306 m) 35°38'N, 120°40'W], on the leeward side approximately 19 miles north and less than 1 mile east of the BBRNA; these sites are labeled on figure 4. Precipitation data are available for these two sites, and since 1960, for Santa Margarita [weather station #7933, Salinas Valley Drainage, elev. 1100 ft. (338 m) 35°22'N, 120°38'W], at the immediate eastern base of the lowest pass (Cuesta Pass) across the Cuesta Ridge approximately two (2) miles northeast of the BBRNA (again see figure 4). Thus, for comparability, all data plotted for this report are those taken for the 35 years from 1960 through 1994, with the exception of 1987 which had missing data for the San Luis Obispo station.

Due to its intermediate geographic position and higher elevation than either the San Luis Obispo or Paso Robles weather stations, the temperatures at Black Butte may be expected to be characteristic of neither site, nor intermediate. In terms of precipitation the Black Butte RNA may be more like the Santa Margarita weather station than it is the other two, although in terms of yearly pattern all three weather sites are significantly correlated. To emphasize the importance of yearly range in temperature, an index of temperateness has been developed (Bailey 1964), and this index is used to communicate the relative mildness or equability of climate. Most perennial or woody plant seedlings are more susceptible to cold and hot extremes than are adults, and thus the temporal sustainability of any vegetation type and its floristic composition is strongly influenced by yearly temperature fluctuation patterns.

To distinguish the distinctly different climates characteristic of the western and eastern sides of the ridge on which the BBRNA is situated, this index was calculated and plotted for the San Luis Obispo and Paso Robles weather stations (figure 5b). These calculations utilized formulas provided in Bailey (op. cit.); they require the average yearly temperature, the difference between the average temperature of the warmest and coldest months, and the standard

deviation across years. This index, termed "equability", has no units, and is designated by the letter M. For the years 1960-1994, figure 5a plots the yearly mean; figure 5b index M; and figure 6 the average temperatures of the warmest and coldest months. The plotted patterns clearly indicate the climatic difference between the regions bracketing the BBRNA. It should be noted, that although index M has a theoretical maximum of 100 and minimum of 0, neither of these values apply to any site on earth. Within California, M ranges from approximately 75 on the north central coast, to just below 45 on the east side of the Sierra Nevada. Thus the ± 12 unit range within the short distance between San Luis Obispo and Paso Robles is particularly noteworthy.

Precipitation data are plotted in figure 7. From these data the orographic influence of the Cuesta Ridge is clear – precipitation is higher at the east base of the Cuesta Pass than to the northeast (Paso Robles) or southwest (San Luis Obispo). Thus, precipitation totals at Black Butte RNA may be expected to approximate more nearly those at Santa Margarita than at San Luis Obispo or Paso Robles. Following, the BBRNA vegetation may be interpreted as of a less equable adaptation and character than in San Luis Obispo, of more equable adaptation than at Paso Robles, but of more mesic requirements than either site. The rapid elevation drop in the eastern canyons of the BBRNA may provide local temperature regiments more like Paso Robles than like San Luis Obispo, while the upper ridges are different from either. Precipitation is likely higher in the BBRNA than even at Santa Margarita, but substantiating quantitative data are not available.

FIRE HISTORY

Although an area such as the BBRNA with large stands of knobcone pine (*Pinus attenuata* Lemm.) would be expected to have had a regular and extensive fire history, and clearly has had such a pre-history, the two known burns on the locality of the BBRNA are recent. However, these two fires, occurring in 1985 and 1994, have been large, and together burned an estimated 90+% of the site. Plates 2 and 3 provide comparable views of the BBRNA pre-1985 and post-1994 burns. Unburned areas in 1994 occur on steep slopes with thin rocky soil and sparse vegetation; in a few random woodland sites, probably those protected by nearby rocky slopes; and in deep canyon bottoms. Dense, eight-year-old successional vegetation was present in 1993 at the initiation of this study. At that time knobcone pines that had germinated post-1985 had one to four years cone crops present (see plate 6), and numerous pine seedlings were present in spring 1995 (post-1994 burn). The Black Butte RNA site, due to its Wilderness Area status, was specifically excluded from artificial reseeding efforts following both the 1985 and 1994 burns. As a result, the BBRNA is remarkably free of the non-native grasses used for reseeding burned slopes.

The winter rainfall season following the 1994 burn was one of the heaviest on record. Although highly beneficial to the native fire-adapted plants, which germinated or crown-sprouted vigorously, heavy erosion and landslides filled the lower canyons with rock and mud debris to an unknown but up to at least 2 meter depth (plate 4). In the lower canyons there was no sign of *Salix* (willow) which had been present, albeit uncommon, in the riparian zone before the fire. Heavy rilling, sheet erosion, and slope collapse affected mostly the lower slopes, with the ridge summits somewhat less affected. Most of the erosion and collapsing appeared to have occurred during a short period, probably during intense downpours. However, there did not appear to be any diminishment of the seed bank, and fire-following germination was

uniformly heavy throughout the BBRNA. Plate 5 illustrates a typical upper-slope stand of *Phacelia grisea* beneath burned knobcone pine/*Arctostaphylos glandulosa* chaparral.

KNOBCONE PINE (*PINUS ATTENUATA* LEMM.)

Black Butte was proposed as a candidate Research Natural Area partly in order to include the knobcone pine forest type within the Research Natural Area program. Knobcone pine (*Pinus attenuata* Lemm.) is near the southern limit of its range in San Luis Obispo County. Although the species ancestry can be traced to the mid-Tertiary in the region of the present Sierra Madre Occidental of Mexico, it has presently only a single extensive stand in California south of San Luis Obispo County; this stand occurs on serpentine in the San Bernardino Mountains (see Griffin & Critchfield 1976). There are populations in Baja California Norte, Mexico; these are near Ensenada (Axelrod 1980) and in the northern Sierra Juaréz (Wiggins, 1977). Although it is apparently not common there, detailed information about its Mexican distribution is not available. United States populations of knobcone pine are most common in the Siskiyou and Klamath Mountains of northwest California and southern Oregon. In the North Coast Ranges it remains common south to Sonoma County, reappears on sterile sands at the type locality near Swanton in Santa Cruz County, then is found scattered throughout the northern Santa Lucia Mountains. The BBRNA populations are disjunct from there. The pine is uncommon in the Sierra Nevada; its southern limit is in Mariposa County near Yosemite, and is from there disjunct north to Placer, Nevada and Eldorado Counties. It is occasional in the Modoc Plateau region, and occurs at its highest elevation on Mt. Shasta.

One of the more interesting aspects of knobcone pine biology and ecology is its affinity for various kinds of relatively sterile soils. In the Klamath Ranges it is most common on ultrabasic parent material, primarily serpentine, occasionally peridotite. It occupies serpentine in the northern Sierra Nevada. Its serpentine occurrences in the North Coast Ranges extend south to Lake County, mostly at elevations above 2500 ft. (~770 meters). At lower elevations in southern Lake, northern Sonoma and Napa Counties, knobcone pine forms extensive, nearly pure stands on acidic volcanic ash deposits (rhyolitic tuff). These populations are usually below 1500 ft (~460 meters). Although the ash deposits may inter-digitate with the extensive serpentine areas at these lower elevations, knobcone pine does not occupy the serpentine derived soils. Although the substratum of every population in the Santa Lucia Mountains is not known, its populations there are apparently not on serpentine. On Cuesta Ridge, knobcone pine is on a siliceous shale of marine origin. Although serpentine is present at essentially identical elevations and under similar climates on the northwest side of Cuesta Pass, less than 5 miles distant, *Pinus attenuata* does not occur there (Junak et al. unpublished list and pers. reconnaissance). The relationship between the serpentine and non-serpentine populations of *Pinus attenuata* would be well-worth investigating. The species absence from serpentine northwest of Cuesta Ridge, the lower elevation habitat and serpentine avoidance of the rhyolite-restricted populations in Sonoma and Napa Counties suggest they may be of different genetic stock. It is interesting also that the reproductive ecology of *Pinus attenuata* is remarkably constant throughout its range – seed dispersal and seedling recruitment occur almost exclusively after fire. Knobcone pine begins producing cones at a young age, often only after 4-7 years. Plate 6 illustrates a less than 10 years old burned individual with several cone crops present. Thus, unless fires are consistently

frequent over a long period, the populations should maintain themselves even when occasional fires occur across unusually short time periods.

BLACK BUTTE PLANT ASSOCIATIONS

Any given combination of plant taxa growing in proximity and within a similar habitat is the historical result of their overlapping ranges of physiological tolerance and reproductive adaptation. These recurring groups of species are treated here as 'associations'. Their physical boundaries often overlap and are thus not always sharply definable on the ground. As closely as can be determined, five association types within the BBRNA correspond in some measure to the plant community designations listed in Holland (1986); four are here considered recognizable. Figure 8 provides a best approximation of the distribution of these types as determined through field reconnaissance; boundaries were drawn from aerial photographs taken in 1978.

The associations present are defined as: 1) knobcone pine forest; 2) chamise chaparral and interior live oak chaparral alone and in mixture; 3) coast live oak woodland; 4) mixed evergreen forest. These are discussed below in turn.

1. **KNOBCONE PINE FOREST** (ELEMENT CODE 83210). (See the knobcone pine discussion above).

Within the BBRNA *Pinus attenuata* forms more or less even-aged stands on ridge summits, occasionally on steep slopes. On ridge summits *Arctostaphylos luciana* (Santa Lucia manzanita) may be an understory component, but often there is no understory at all, or only infrequent herbs are present. Species characteristic of chaparral are sometimes associated with the pines, and, except for the difference in frequency and presence of *Pinus attenuata*, these two associations are similar in composition. Dominated by *Pinus attenuata*. Less frequent are *Arctostaphylos luciana*, *Arctostaphylos glandulosa* var. *cushingiana*, *Garrya veatchii*, *Quercus wislizenii* var. *frutescens*.

2. **CHAMISE CHAPARRAL** (ELEMENT CODE 37200), **INTERIOR LIVE OAK CHAPARRAL** (ELEMENT CODE 37A00).

Chaparral shares dominance within BBRNA with the knobcone pine and mixed evergreen forest associations. The chaparral types are actually more complex than can be accommodated even by combining the two types listed above. The characteristic component species are recombined in a complex interdigitating mosaic, largely effected according to aspect, drainage, or parent material aspect, i.e. strata that lie vertically, diagonally or horizontally. On ridgetops where the slopes are less severe than in most parts of the BBRNA, *Arctostaphylos luciana* is sometimes a dominant (see plate 1); in these situations it may form nearly pure stands. Although hard data are lacking, these sites may be correlated to situations where the sedimentary strata are in more or less horizontal layers from which water drains quickly. The relatively xeric conditions result in little topsoil formation or litter accumulation. *Arctostaphylos luciana* may be a sole dominant but is more often mixed with *Lotus junceus* and *Adenostoma fasciculatum;* it is thus here considered a specialized phase of the common chamise chaparral type. Nearly pure stands of *Adenostoma* may form on some steep slopes, but this species is also often mixed with knobcone pine on ridgetops and upper slopes. *Quercus berberidifolia* and *Quercus wislizenii* var. *frutescens* are most often near ridgetops where soil conditions are not amenable to *Arctostaphylos luciana*, but these three species may also

occur together. Scrub oaks, (*Q. wislizenii* var. *frutescens*, *Q. berberidifolia*, and *Q.* cf. *john-tuckeri*) sometimes occur on steep and rocky slopes from which chamise appears excluded, and they are commonly found on the edges of dense knobcone pine stands, although rarely within them. Dominated by *Arctostaphylos glandulosa* var. *cushingiana*, *Arctostaphylos luciana*, *Quercus wislizenii* var. *frutescens*, *Adenostoma fasciculatum*, *Lotus junceus*. Less frequent are *Garrya veatchii*, *Quercus berberidifolia*, *Quercus durata*, *Pickeringia montana*, *Dendromecon rigida*, *Eriodictyon traskiae*, *Helianthemum scoparium*, *Rhamnus ilicifolia*, *Prunus ilicifolia*, *Cercocarpus betuloides*, *Artemisia californica*, *Lupinus albifrons*.

3. **COAST LIVE OAK WOODLAND** (ELEMENT CODE 71160).

Areas with deeper soil development which are also on south-facing or sometimes west-facing slopes have open, nearly pure stands of *Quercus agrifolia* (coast live oak). Coast live oak also enters the mixed evergreen forest in combination with other species. Its associates include a few understory or light gap shrubs such as *Holodiscus discolor* in shaded sites, or *Lupinus albifrons* in open sunny sites, but the woodland understory and intervening openings among trees are mostly occupied by herbaceous species. The overstory density is highly variable, ranging from complete closure to widely spaced trees such as on the southwest face of Peak 3 (see plate 2). This association has few members in common with the chaparrals or knobcone pine forest. A few herbaceous taxa such as *Lathyrus vestitus*, *Sanicula crassicaulis*, and *Polypodium californicum* are (in the BBRNA) primary members of the mixed evergreen forest, and secondary components of coast live oak woodland. The coast live oak woodland is dominated by *Quercus agrifolia*. The understory consists mostly of herbs but occasional shrubs of *Holodiscus discolor*, *Antirrhinum multiflorum*, *Lupinus albifrons* and *Rhamnus californica* are present.

4. **MIXED EVERGREEN FOREST** (ELEMENT CODE 81100).

Mixed evergreen forest occurs mostly on higher north-facing slopes. Where it occurs on lower slopes these are always sites where shading provides cool, relatively mesic conditions. Among the plant associations at BBRNA, this one clearly prefers and dominates the more mesic situations.

The mixed evergreen forests of the BBRNA are dominated by *Lithocarpus densiflora*, *Quercus chrysolepis* and *Arbutus menziesii*. Locally important are *Acer macrophyllum*, *Quercus agrifolia* and *Umbellularia californica*. Less frequent are *Ceanothus oliganthus* var. *sorediatus*, *Sambucus mexicana*, and *Holodiscus discolor*. These forests fill the canyon bottoms, and extend far upslope on north-facing slopes. In the canyon bottoms the tree layer is more or less closed and to 20 m. high. In the understory is both a shrub layer and a diverse herbaceous layer. Where the forest extends upslope, the tree layer becomes shorter and more open. These upslope forests are perhaps best described as woodlands. In the upslope stands, the herbaceous layer is sparse and of few species.

Biogeographically this is the most interesting mixture of plants in the BBRNA. The Santa Lucia Mountains have a strongly north/south trending ridge summit in close proximity to the ameliorating effects of the Pacific Ocean. During cool, moist, later Pleistocene climates (Wisconsin primarily), this physico-geographic position promoted the migration southward of ancestral mixed evergreen forest components. These plants are currently relict in cool, shaded canyons, and on moist passes, within the Santa Lucia and Santa Ynez Mountains. Many of the

common component taxa are seldom seen south of Monterey County. *Lithocarpus densiflora* extends only to the summits of the Santa Ynez Mountains in the vicinity of San Marco Pass above Santa Barbara; both *Arbutus menziesii* and *Acer macrophyllum* are rare south of there although both occur in isolated sites south to San Diego County. Among the herbaceous flora, both *Fritillaria affinis* (excluding *F. ojaiensis* Davidson) and *Madia madioides* are near or at their southern limit in the BBRNA; although *Aralia californica* is not restricted to mixed evergreen forest throughout its range, it is also approaching the southern limit of its tolerance here.

VEGETATION SAMPLING AT BLACK BUTTE

Vegetation sampling was interrupted by a major wildfire which temporarily altered the vegetation structure within the BBRNA. Pre-burn sampling was carried out by John Hunter in May 1994, immediately prior to the 1994 fire and provides the only record of vegetation structure between that fire and the previous fire of 1985. Post-burn sampling was carried out May 29-June 4 1995 by Katie Phillips (USDA Forest Service, Pacific Southwest Research Station), A. Flinck (Santa Barbara City College), and Gary Montgomery (Los Padres National Forest).

Pre-burn sampling

Releve methods were used to assess the overall heterogeneity of the vegetation within BBRNA an to determine the necessary range of further quantitative sampling. Releve sites were chosen subjectively to represent the range of conditions present in the study area. Locations are shown in Figure 9. At each site a plot 20m by 20m in size was delineated within an area of relatively homogeneous vegetation. Total cover of each plant species present within the plot was estimated and recorded by cover class, and additional site attributes were noted (Table 1).

Post-burn sampling

Sample sites were drawn from a set of randomly chosen points to include burned and unburned representatives of each of the major plant communities. Characteristics of these sites are shown in Table 2, locations are shown in Figure 9. At each site, vegetation composition and vertical structure were measured using line-point methods. A transect line was laid out along a randomly chosen bearing to a length of 25m on chaparral sites and to a length of 50m on forest and woodland sites. Vegetation characteristics were recorded at 0.5 meter points along this transect line. All plant species present (defined by canopy perimeter) in the vertical projection of each point were recorded, as were ground surface characteristics and presence/absence of live and dead plant canopy by height stratum. Cover estimates in tables 3 and 4 were calculated from these point data. For additional information on population structure of woody plants and abundance of plant species that form minor components of cover, a complete count was made of individual plants rooted within a belt 1m wide centered on the transect line. Individuals were tallied by species and, for woody plants, by size class. Data on species composition and soil surface characteristics are presented in Table 3. Data on vertical structure of vegetation are presented in Table 4. Table 5 shows density of woody species by size class calculated from belt transect counts.

SENSITIVE OR SPECIAL INTEREST PLANT SPECIES AT BLACK BUTTE

Three plant species of limited distribution, *Arctostaphylos luciana*, *Agrostis hooveri*, and *Calochortus clavatus*, were observed during field work performed for this report. Distributions within the BBRNA are plotted on Figure 10. Their variation and habitats within the BBRNA are further discussed within the floristic compilation provided as Appendix I. The following data are taken from field reconnaissance notes, published information within the California Natural Diversity Database: List of Special Plants, and the California Native Plant Society publication "Inventory of Rare and Endangered Plants of California" (Skinner et al. 1992).

1. *Agrostis hooveri* Swallen (Hoover's bentgrass).

A population of *Agrostis hooveri* was found at the west base of Ridge 2 (see Figure 10 and Figure A, Appendix I). The plants are numerous, and although a detailed census was not taken, the population contains at least one hundred individuals. This site was formerly a ridgeline ecotone between coast live oak woodland on the south-facing slope, and a knobcone pine forest on the ridgetop. It was burned heavily in 1994, and is currently open; it could be anticipated that the closure of the canopy as regrowth proceeds will limit the population of this species in future decades. *Agrostis hooveri* is included on the California Native Plant Society List 4 (Watch List) and is known from numerous localities in coastal northern Santa Barbara and San Luis Obispo Counties. It has no other legal status.

2. *Arctostaphylos luciana* P. Wells (Santa Lucia Manzanita) Plate 7.

Large populations of this smooth-barked, non-burl-forming manzanita are found within the BBRNA. Its habitat is restricted to ridge summits on the thin-soiled siliceous shale which dominates the southeast Cuesta Ridge. A longer discussion of *Arctostaphylos luciana* variation and distribution within the BBRNA is provided in Appendix I. Obligate seed-reproducing manzanitas generally require a moderate to lengthy inter-fire period to allow plant maturity and seed bank restoration (Haidinger & Keeley 1993; Wells 1969). Evidence suggests that even among related *Arctostaphylos* lineages, the evolution or retention of a burl (lignotuber) may be directly linked to regional fire frequency. The lack of such a structure may in converse be the result of occupation of relatively fire-protected habitat (Keeley, Massihi, & Goar 1992). Thus, although the continued presence of this taxon in the BBRNA is likely assured, fire intervals as short as those recently seen at Black Butte are probably detrimental in the long term to *Arctostaphylos luciana*.

The population within the Black Butte boundaries clearly consists of many thousands of individuals. It is not known what proportion of the total BBRNA population was burned in the 1985 and 1994 fires, but most of the unburned populations are on the ridge forming the BBRNA western boundary. Mature individuals within the disjunct sub-populations on the east-trending ridges within the BBRNA proper (see Figure 10) are now scarce, and this area will for the most part be populated by individuals germinating post-1994. Among the dominant woody species within the BBRNA, this one appears the most characteristic of ridgetops where the Monterey shale strata lie horizontally. This taxon is on California Native Plant Society List 1B. Neither its habitat nor populations are currently endangered.

Written material provided by the USFS appeared to confuse *Arctostaphylos glandulosa* f. *cushingiana* (sensu Wells in Hickman ed. 1993) with *Arctostaphylos obispoensis* Eastw., another special-status

1993) with *Arctostaphylos obispoensis* Eastw., another special-status manzanita. The latter species is not present on the southeast Cuesta Ridge – it is restricted to serpentine on the northwest side of the Cuesta Pass. It is absent from the BBRNA, although its genetic influence may be present (see discussion in Appendix I).

3. *Calochortus clavatus* S. Watson ssp. ***clavatus*** (Club-haired Mariposa Lily)

Calochortus clavatus is rare within the BBRNA; it is currently known only from two (2) individuals growing on a shale outcrop at the eastern summit of the ridge running east from Radio Facility 2 (see Figure 10, Figure A, Appendix I, and compare Figure 8). This site is in the ecotone of coast live oak woodland and *Adenostoma*-dominated chaparral. *Calochortus clavatus* is more common in the serpentine areas on the northwest side of Cuesta Pass, and neither its habitat nor populations outside the BBRNA are currently endangered. The tiny population within the BBRNA is likely unstable and could expand or disappear in future decades. *Calochortus clavatus* ssp. *clavatus* is on California Native Plant Society List 4, Watch List. It has no other legal status.

POST-BURN OBSERVATIONS ON VEGETATION STRUCTURE AND FLORISTIC COMPOSITION.

General Vegetation Response

Pre- and post-burn ground-level observations indicate that boundaries between vegetation patches seem to have changed little after the 1985 and 1994 burns. This resilience has been noted before for the area (Wells 1962), and fits with the strong influence that topography and substrate have on the region's vegetation.

Mixed Evergreen Forest

In general, the angiosperm trees within these forests produce vigorous basal sprouts when damaged by fire or cutting. Post-fire mortality is generally low, and in several decades after fire a closed canopy re-forms from both sprouts and individuals recruited by seed. The dynamics of the mixed evergreen forest in the BBRNA follow the above pattern. However, the post fire dynamics of the BBRNA forests seem to have both herbaceous and shrub dominated phases prior to canopy closure. These stages of succession in mixed evergreen forest have received little attention.

The 1985 fire top-killed virtually all trees within the upslope forests, but in the canyon bottoms most trees were either unburned or survived without being top-killed. Where stands had experienced extensive top-killing, large amounts of dead stems and branches were piled on the ground, as the fire had not consumed the crowns. Nine years later (1994) the upslope forests were dominated by 2-4 meter high sprouts from the base of the trees which had been top-killed, together with a high seed-recruited cover of *Ceanothus oliganthus* var. *sorediatus*. In 1993 these stands were nearly impenetrable due to both this low dense canopy and the dead wood, beneath which the herbaceous layer was relatively sparse. In contrast, the canyon bottom forests were still dominated by trees which had survived the fire, creating an open canopy beneath which there was a discontinuous layer of tree sprouts and shrubs, particular the aforementioned *Ceanothus oliganthus* var. *sorediatus*.

In mixed evergreen forests, the prominent post-fire role of *Ceanothus* species has been generally over-looked and these species are rarely considered an important component of these forests. Yet *Ceanothus* species have been observed as post-fire dominants in the *Quercus chrysolepis-Pseudotsuga macrocarpa* forests of the San Bernardino Mountains (Minnich, 1988), here in the Santa Lucia Mountains, and in the *Pseudotsuga*-mixed hardwood forests of the North Coast (Hunter 1995) and further north (Conard et al. 1985).

The 1994 fire consumed the dead wood from the 1985 fire and again top-killed almost all trees in most upslope forests. In the canyon bottoms, however, the fire top-killed only a portion of the canopy in most stands. Two years after the fire (spring 1996) the second author revisited the site and discovered that sprouts of trees and shrubs were less than 2 meters high, covering only a portion of the ground. The remaining ground area was covered by a dense herbaceous layer dominated by *Lotus crassifolius, Lotus junceus, Pteridium aquilinum, Claytonia perfoliata, Toxicodendron diversilobum* and *Galium aparine* (see data in Table 3, transect 12). *Ceanothus* seedlings were still at this time confined to the herbaceous layer.

Few angiosperm trees were killed by these fires. Most burned trees produced basal sprouts and survived. In spring 1996, within four 4 meter by 10 meter plots located within the mixed evergreen forest, 83 of 91 trees had produced basal sprouts and were still alive (J. Hunter, unpresented data). The 8 trees which had no living sprouts could have been killed by either fire or may have died at some other time. All but one of these dead trees had been small probably suppressed stems prior to the fires. Many stems were in clumps or rings attached to large charcoal-covered basal burls up to 2 meters across, indicating that these trees had survived repeated top-killing through resprouting.

Coast live oak woodland

Many stands of *Quercus agrifolia* woodland were not top-killed by the 1985 fire. Whether this was due to the pattern of the fire, the availability of fuel in these forests, or the coast live oak's resistance to fire damage, we do not know. In some stands, tree crowns seemed to have been partially killed by the fire, and then replaced by epicormic sprouts. The 1994 fire burned as a ground fire through some woodland areas and removed the crown in others. It is still too early to tell if oak trees which have epicormic sprouts from their larger branches will continue to survive. Often tree crowns can survive for several years after the trunk cambium has been completely killed (J. Hunter, pers. obs.). In addition, the first author in 1981 observed in the San Rafael Wilderness of Santa Barbara County 15 year post-burn coast live oak trees with heavy epicormic sprouting. The bark and cambium had been burned through in these trees. The trees were alive but heavily festooned with wood rot fungi fruiting structures. In any case, within the BBRNA, in many stands at least some *Quercus agrifolia* were top-killed by the 1994 fire. Most of these trees have already produced basal sprouts.

Chaparrals

In the BBRNA there seems to be a significant distinction in post-fire dynamics between the open and closed-canopied patches of chaparral. Most closed-canopied patches had their entire canopy removed by both the 1985 and 1994 fires. However, the fires burned much more discontinuously within the open-canopied patches of chaparral. These

open-canopied patches are on steep slopes with large areas of rock outcrop. These outcrops are a visibly striking component of the BBRNA landscape (visible in the background of Plate 5). Within these patches, many shrubs passed through both fires without their tops being burned. Over long periods of time, these areas may allow some populations to persist which otherwise would be eliminated by periods of frequent fire. This mechanism is apparently responsible for the presence and near-restriction of *Pinus coulteri* to these rock outcrops. Most *Pinus coulteri* survived both fires in these open-canopied rocky areas. The floristic compositions of the open- and closed-canopied chaparrals are distinctly different. While the closed-canopied areas are dominated by *Adenostoma fasciculatum*, *Arctostaphylos glandulosa*, *Arctostaphylos luciana*, *Pickeringia montana*, and *Dendromecon rigida*, the open-canopied stands have significant proportions of *Quercus wislizenii* var. *frutescens*, *Prunus ilicifolia*, *Cercocarpus betuloides*, *Heteromeles arbutifolia*, and *Quercus berberidifolia*.

Knobcone Pine Forest

Within the BBRNA, most stands of *Pinus attenuata* were burned by both fires. The canopy was completely removed from the burned stands. As *Pinus attenuata* does not resprout, it depends entirely upon regeneration from seed. The short interval between the 1985 and 1994 fires allowed the pines to accumulate only a few years of seed (stored in serotinous cones). Nonetheless, there appears to be enough regeneration in these stands to assure that *Pinus attenuata* will remain a dominant in the region. Two years after the 1994 fire, in six 1 meter by 10 meter plots in burned *Pinus attenuata* stands, there were 27 dead trees and 29 seedlings (J. Hunter, unpresented data). Although these seedlings were 15-30 cm. high, no doubt some will die before maturity; thus post-1994 burn *Pinus attenuata* density may possibly be slightly lower compared to pre-1994 burn.

Among the *Pinus attenuata* stands the herbaceous species response to fire was highly variable. *Scrophularia californica* was a significant dominant in several sites, flowering heavily its first year and appearing much like an annual, although the species is clearly perennial. Large seedling cohorts of *Lotus crassifolius* (see Appendix I) also appeared about some of the burned knobcone pine stands. This perennial species is relatively rare in San Luis Obispo County. It is moderately shade-tolerant and should persist here in large numbers for the foreseeable future.

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Plate 6. Upper portion of an approximately 10-year old *Pinus attenuata* (knobcone pine).

Plate 7. *Arctostaphylos luciana* P. Wells (Santa Lucia manzanita).

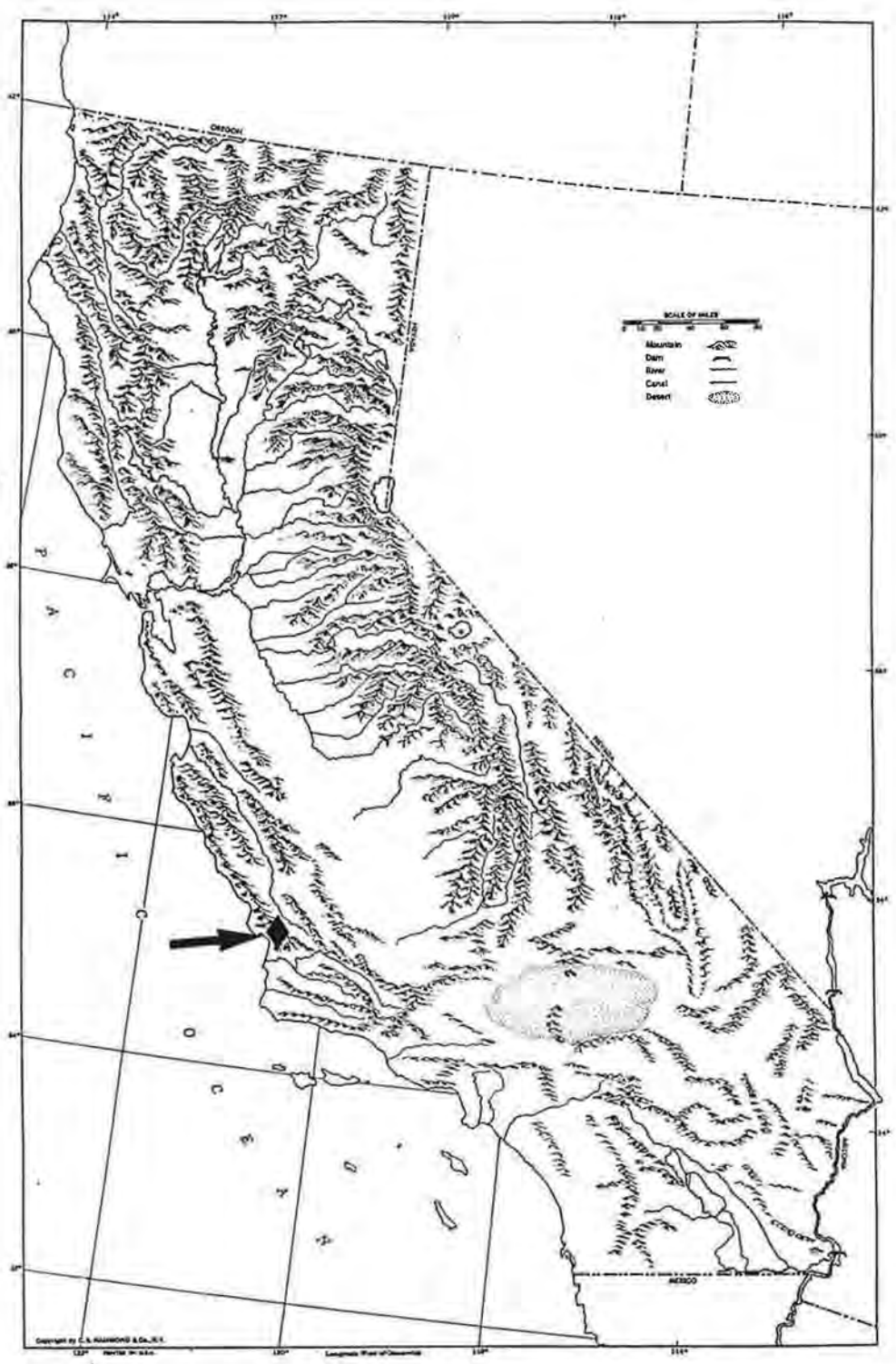


Figure 1 LOCATION WITHIN THE STATE OF CALIFORNIA of the Proposed Black Butte Research Natural Area, Los Padres National Forest, San Luis Obispo County.

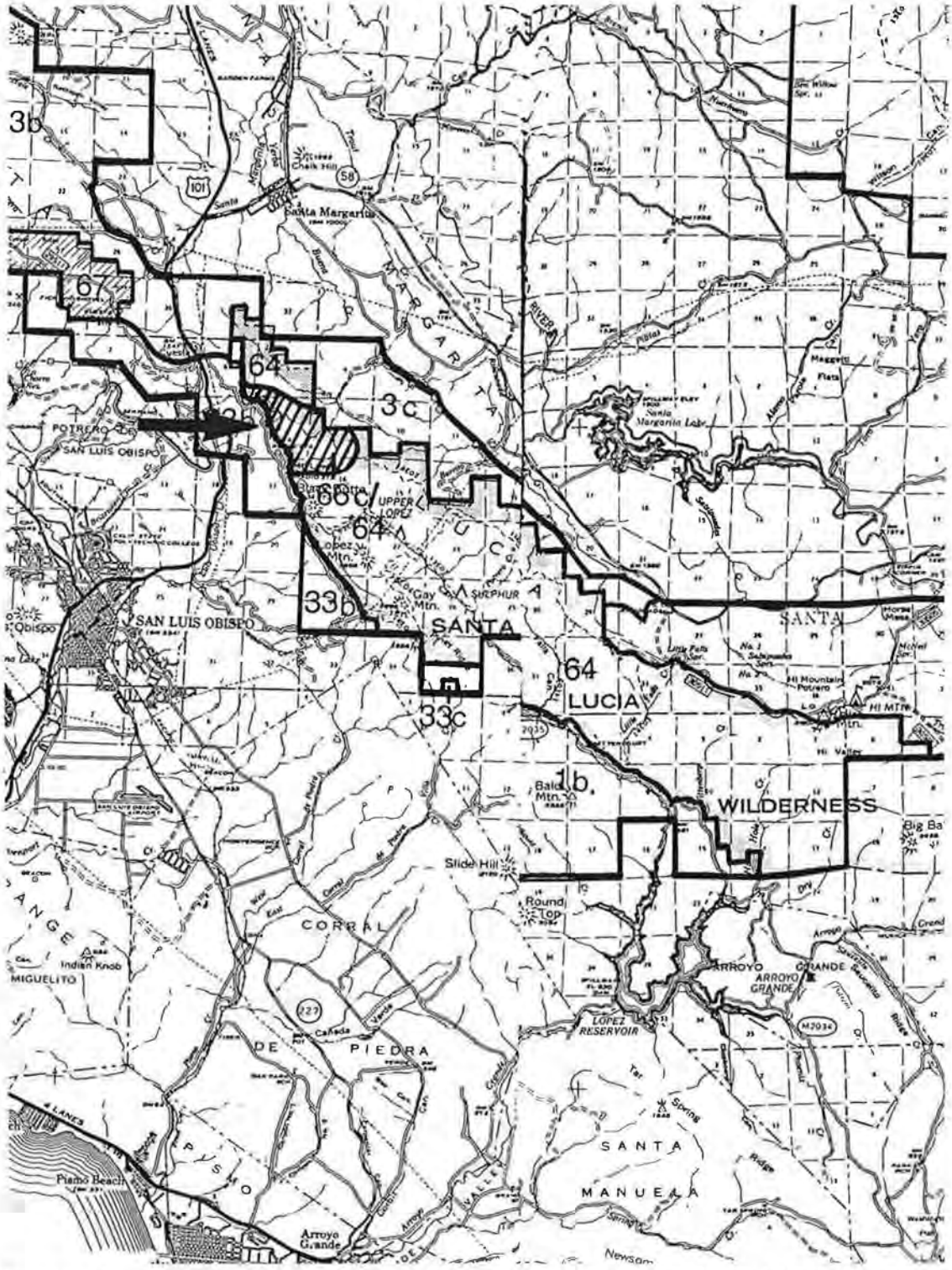


Figure 2 LOCATION OF THE PROPOSED BLACK BUTTE RESEARCH NATURAL AREA WITHIN THE LOS PADRES NATIONAL FOREST, SANTA LUCIA WILDERNESS AREA. Forest Service Road 30S11 is marked. This is the only road access into the RNA currently available to the public; it may be used on foot or by non-motorized vehicle.

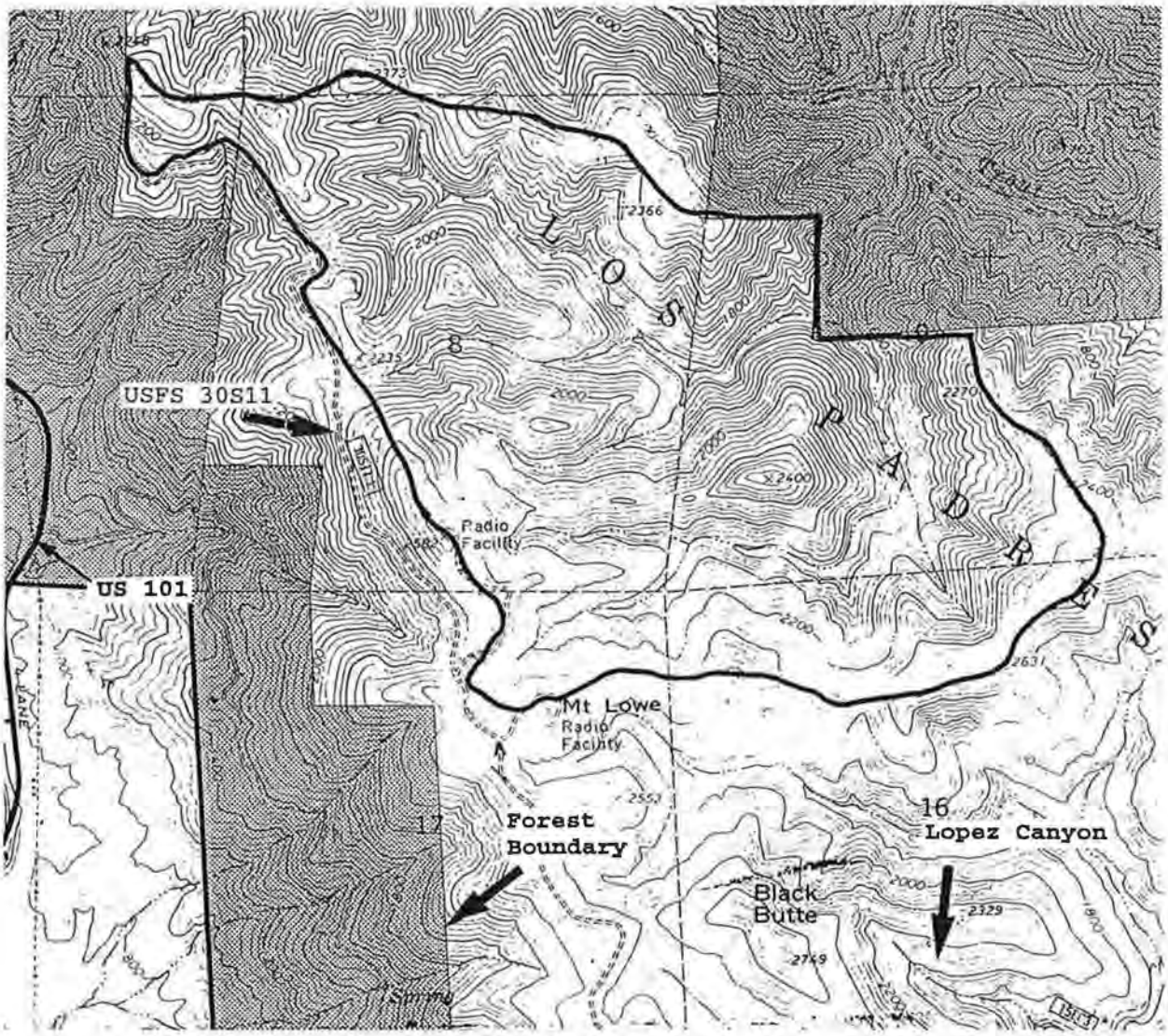
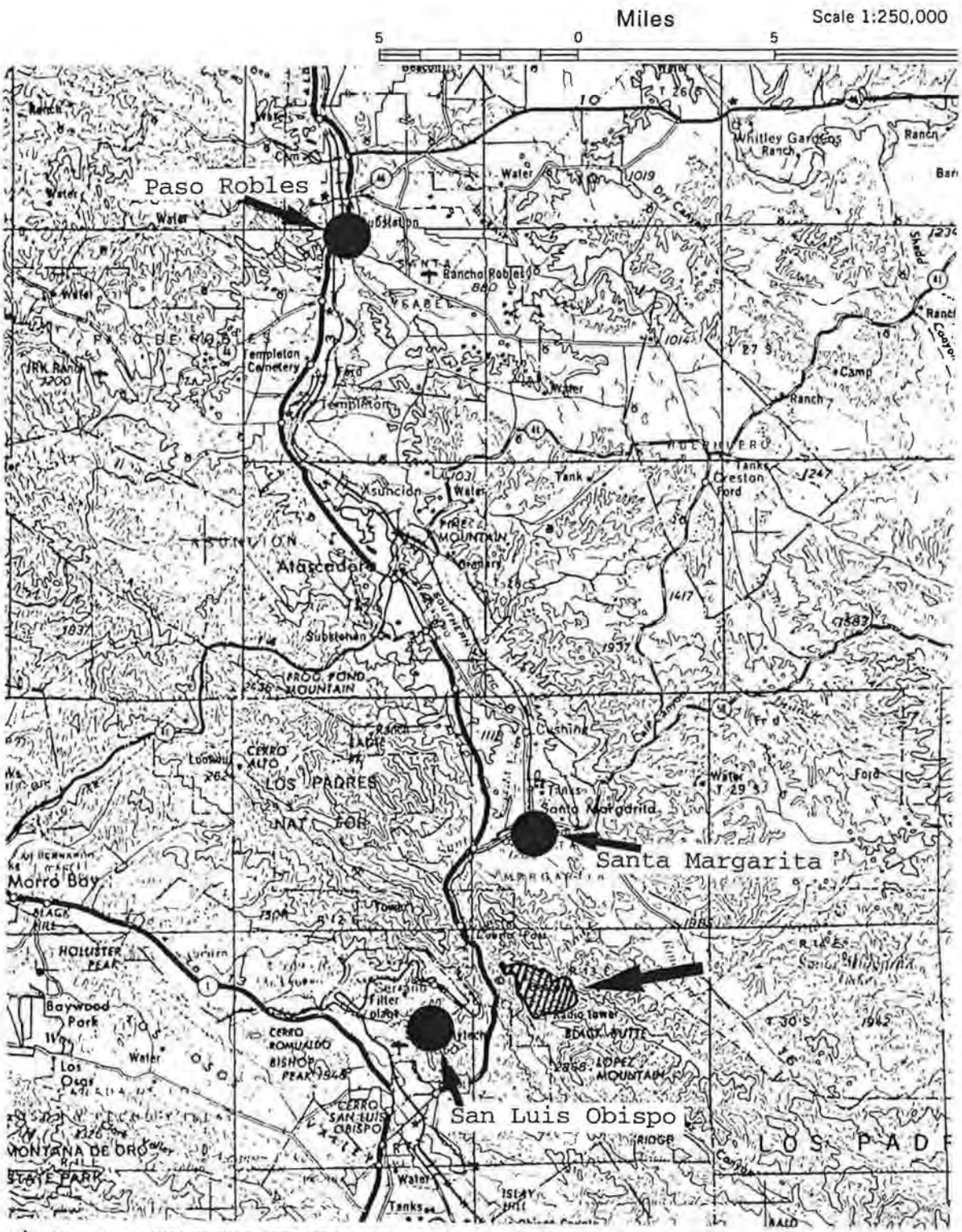


Figure 3 APPROXIMATE BOUNDARIES OF THE PROPOSED BLACK BUTTE RESEARCH NATURAL AREA. Lopez Mountain, 7.5' USGS Quadrangle. Forest Service Road 30S11 is marked. This is the only access into the RNA currently available to the public; it may be used on foot or by non-motorized vehicle.


Miles
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Paso Robles
Santa Margarita
San Luis Obispo
Morro Bay
Templeton
Atascadero
Whitley Gardens
Rancho Robles
Templeton Cemetery
Creston
Santa Margarita
Cushing
Tanks
Ford
Camp
Ranch
Water
Tank
Tanks
Creston
Ford
Xsuncion
Water
Atascadero
Subsistence
Cushing
Water
Santa Margarita
Tanks
Ford
Morro Bay
Baywood Park
Los Osos
Water
Filter plant
Radio tower
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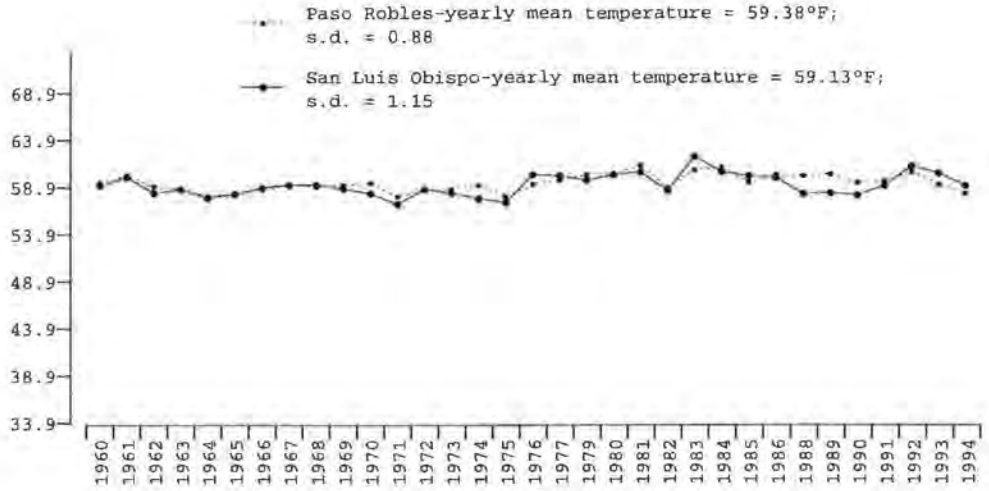


Figure 5a Yearly mean temperatures for weather recording stations at Paso Robles and San Luis Obispo. Temperature data are not available for the Santa Margarita weather station. Vertical axis scaled to the approximate range within California. Yearly means within the RNA probably do not differ significantly from those shown here.

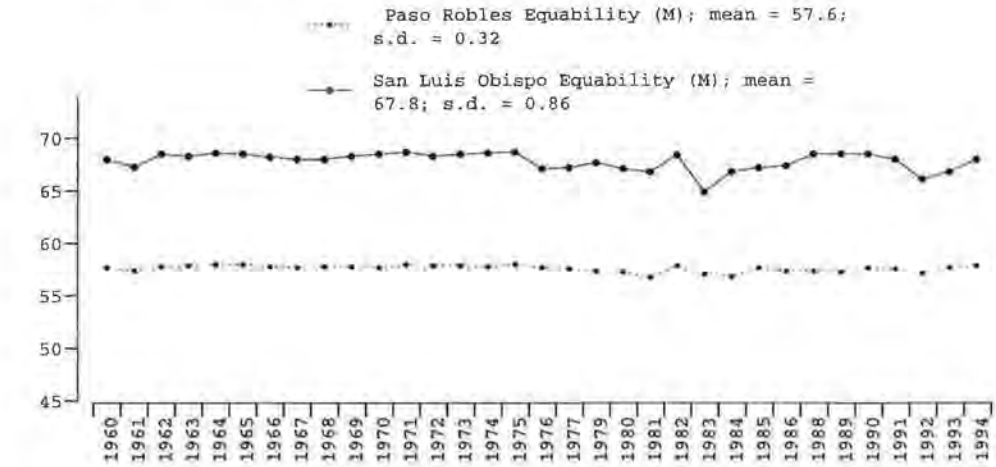


Figure 5b Yearly calculated equability Index M (see Bailey 1964) for weather stations at Paso Robles and San Luis Obispo. The vertical axis is scaled to the approximate range of equabilities found within California. Equability is (in large part) determined by the range of temperatures between the means of the warmest and coldest months for a given site; it is a primary determinant of plant establishment and survival. The wide difference between the two regions is indicative of the potential difference in climate (and thus plant adaptation requirements) between the western and eastern portions of the RNA. See text for further discussion of Index M.

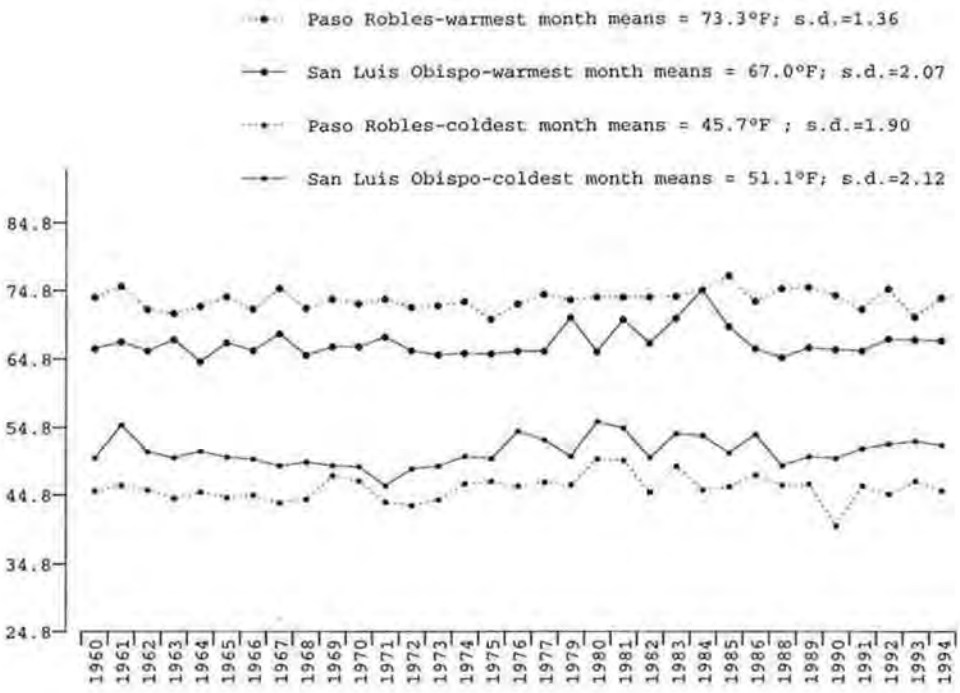


Figure 6 Range of mean temperatures for the warmest and coldest months at the Paso Robles and San Luis Obispo weather stations (see Figure 4 for location of these stations). Vertical axis scaled to the approximate range within California (min=24.8°F, Soda Springs; max=92.6°F, Brawley). Due to its generally higher, but variable, elevation, these data may not reflect the actual ranges within the RNA.

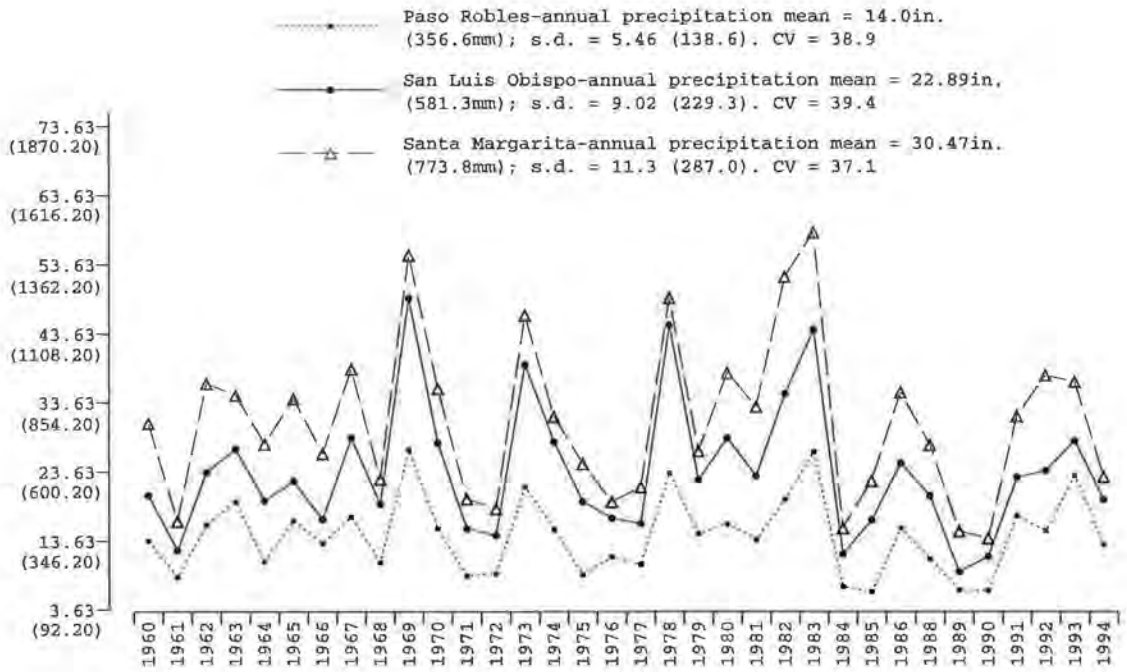
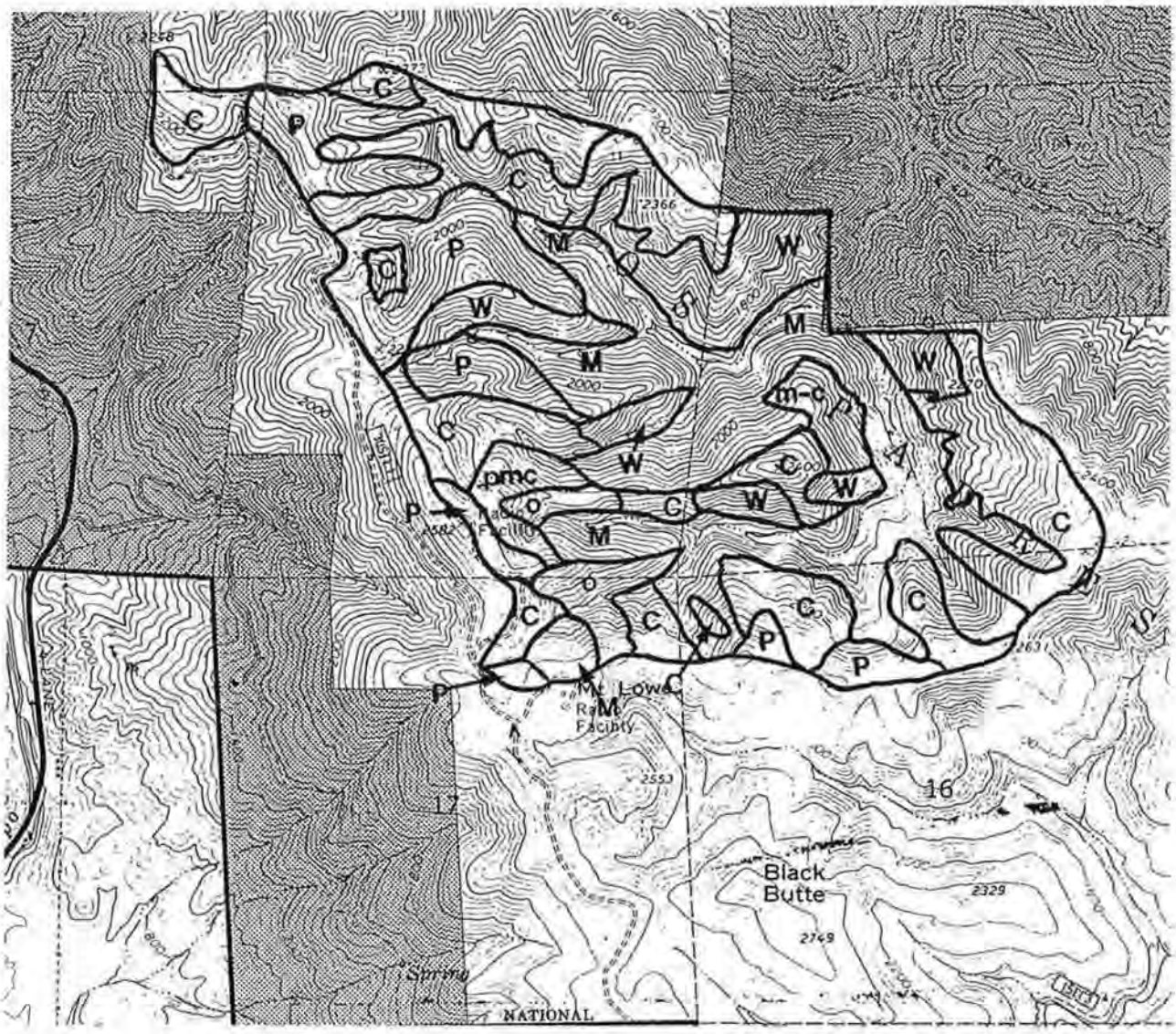
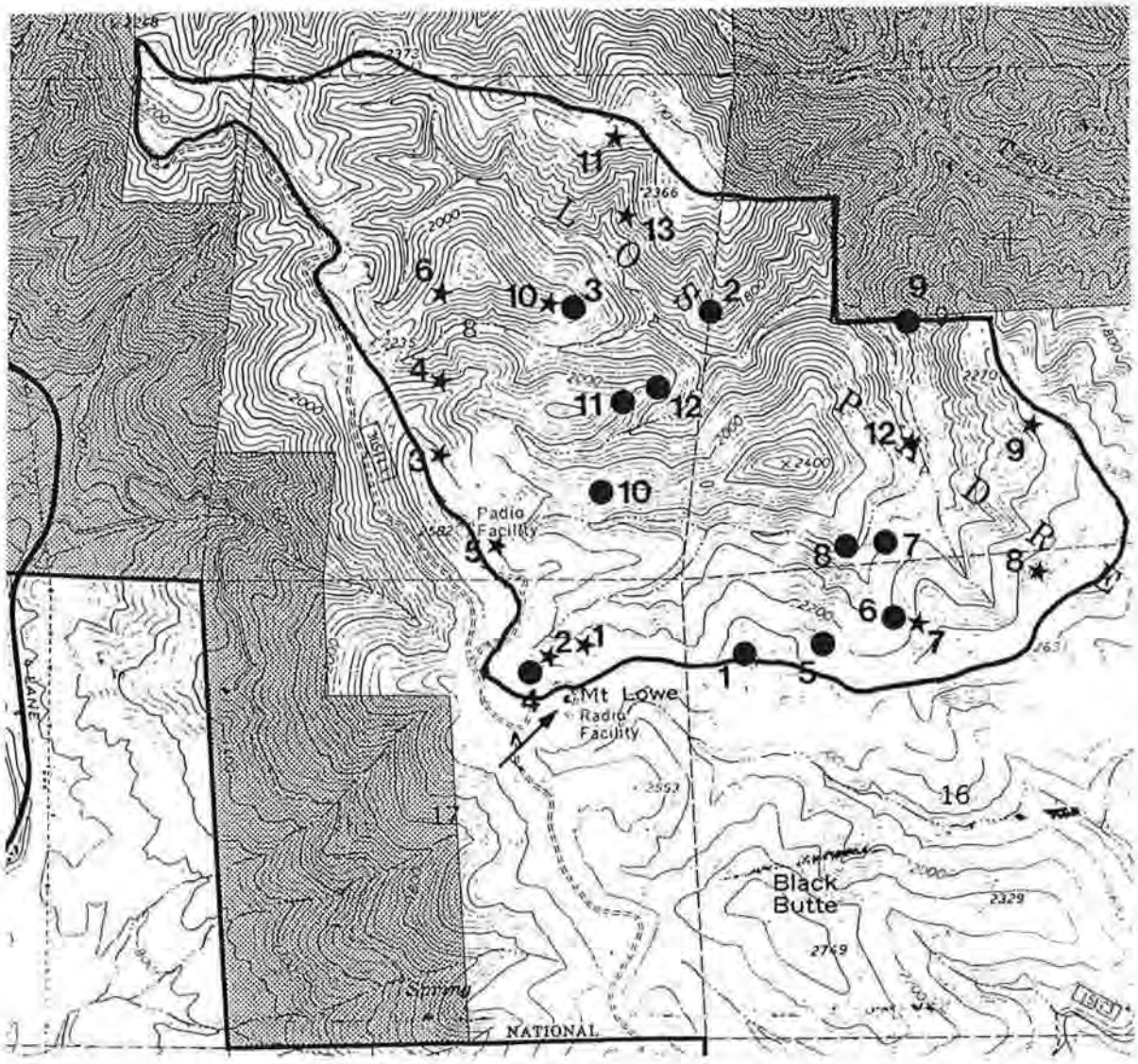


Figure 7 Precipitation from 1960 through 1994 (1987 missing) for weather stations at Paso Robles, San Luis Obispo, and Santa Margarita. Vertical axis scaled to reflect the approximate range of yearly precipitation within California as a whole [3.63in.(92.2mm) at Indio to 75.59in.(1917.7mm) at Upper Mattole]. Santa Margarita is located on the RNA lee side and probably has a similar precipitation pattern to that occuring within the RNA. The precipitation at this station is higher than at San Luis Obispo or Paso Robles, reflecting the orographic influence of the Cuesta Ridge. The persistance of mixed evergreen forest at Black Butte is probably due to the higher precipitation on the ridge than in the lowlands to the west and east. The historically wide year to year variation in this region reflects to some extent the central location of the RNA within California (see Figure 1). Note the consistency among the coefficients of variation (CV), reflecting the similar precipitation patterns among the three sites. See Figure 4 for weather station locations.



C = chaparral ± closed canopy with *Adenostoma*, *Quercus wislizenii* var. *frutescens*, *Arctostaphylos*.
W = Coast Live Oak (*Quercus agrifolia*) Woodland.
M = Mixed Evergreen Forest with *Quercus chrysolepis*, *Lithocarpus*, *Arbutus*.
P = Knobcone Pine (*Pinus attenuata*) forest.
o = open chaparral with Coulter pine (*Pinus coulteri*) on exposed, steeply dipping bedrock.

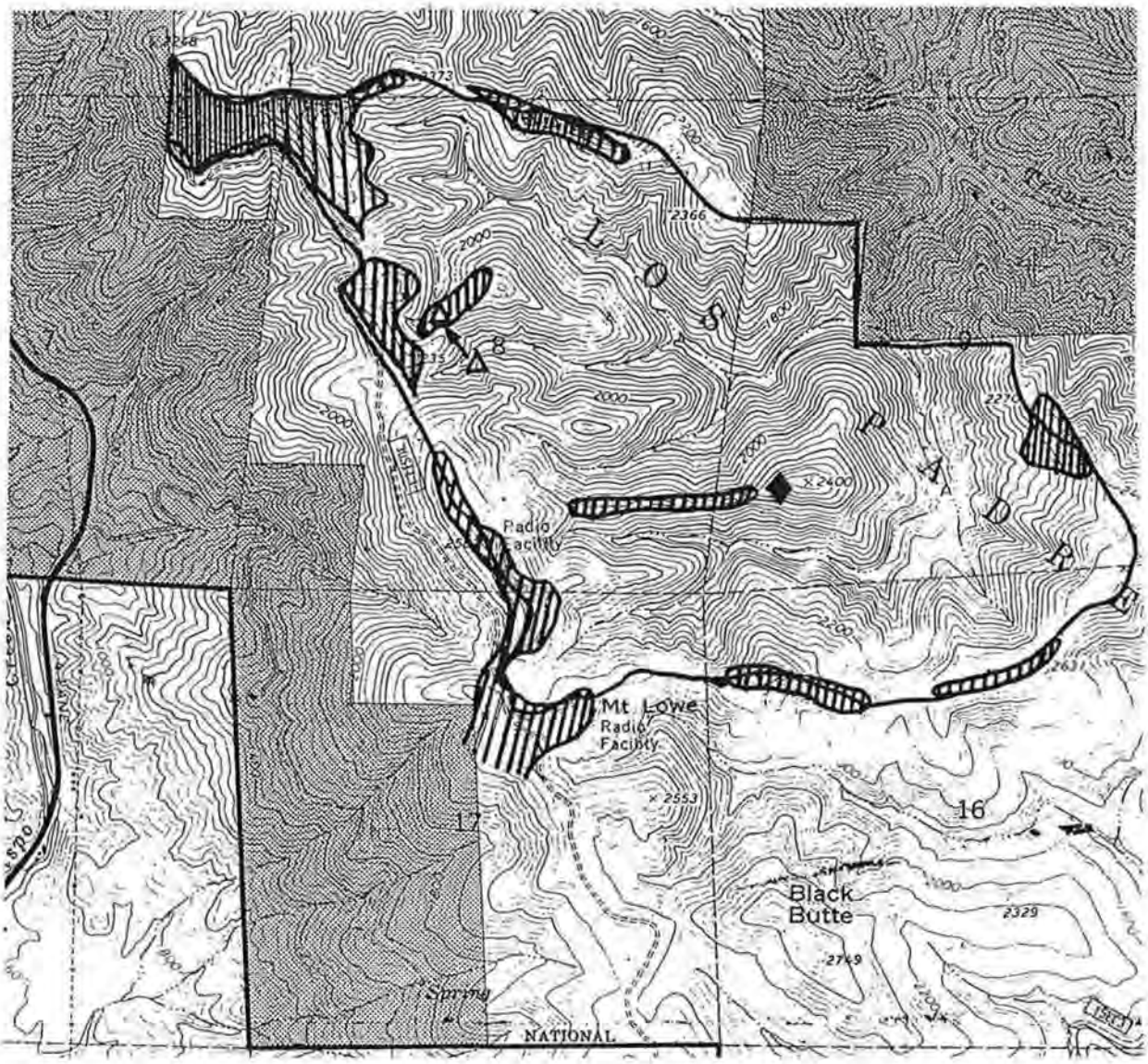
Figure 8 DISTRIBUTION OF PLANT ASSOCIATIONS WITHIN THE PROPOSED BLACK BUTTE RESEARCH NATURAL AREA. Areal distributions are superimposed on the Lopez Mtn. 7.5' USGS quadrangle. See text and tables for species compositions and regional variation. Drawn from aerial photographs taken in 1978.



● = Locations of pre-burn releves.

★ = locations of post-burn transects.

Figure 9 LOCATIONS OF RELEVES AND TRANSECTS ASSESSING VEGETATION AND FLORISTIC COMPOSITION WITHIN THE PROPOSED BLACK BUTTE RESEARCH NATURAL AREA. The locations are superimposed on the Lopez Mtn. 7.5' USGS quadrangle. See text and tables for species compositions.



◆ = Locality for *Calochortus clavatus* S. Watson

△ = Locality for *Agrostis hooveri* Swallen

▨ = Approximate distribution of *Arctostaphylos luciana* P. Wells, within and in the vicinity of the study area. Populations also extend south of the RNA.

Figure 10 LOCATIONS OF PLANT SPECIES WITHIN THE PROPOSED BLACK BUTTE RESEARCH NATURAL AREA WHICH ARE OF LIMITED DISTRIBUTION THROUGHOUT THEIR RANGES. The locations are superimposed on the Lopez Mtn. 7.5' USGS quadrangle. See text and Appendix I for further discussion of these taxa.

TABLE 1† PRE-BURN RELEVES: ESTIMATED TOTAL COVER. See figure 9 for releve locations. These data are the only record of pre-burn vegetation in the RNA.

Releve 1	Species	[1]Total Cover
El. 800 m	SHRUB LAYER:	
Aspect: W	*Arctostaphylos luciana*	3
Slope: 20%	*Pinus attenuata*	2-3
Soil: stony	*Arctostaphylos glandulosa*	1
scree	*Dendromecon rigida*	1
Position:	*Lotus junceus*	1
ridgeline	Total cover:	4-5
	HERB LAYER:	
	Lamarckia aurea	+
	Vulpia microstachys	+
	Dactylis glomerata	+
	TOTAL:	+

Releve 2	Species	[1]Total Cover
El. 566 m	TREE LAYER:	
Aspect: S	*Quercus agrifolia*	2
Slope: 75%	*Arbutus menziesii*	1
Soil: stony	*Pinus coulteri*	1
loam	*Umbellularia californica*	1
Position:	TOTAL:	2
lower slope	SHRUB LAYER:	
	Eriodictyon traskiae	2
	Lupinus albifrons	2
	Mimulus aurantiacus	2
	Quercus agrifolia	1 (sprouts)
	Lotus scoparius	+
	Ceanothus oliganthus	+
	Ribes malvaceum	+
	Rhamnus californica	+
	Antirrhinum multiflorum	+
	TOTAL:	5
	HERB LAYER:	
	Pteridium aquilinum	3
	Melica imperfecta	1-2
	Bromus diandrus	1
	Eschscholzia caespitosa	+
	Pterostegia drymarioides	+
	Sonchus oleraceus	+
	Avena barbata	+
	TOTAL:	3-4

Releve 3	Species	[1]Total Cover
El. 585 m	TREE LAYER:	
Aspect: S	*Quercus agrifolia*	4
Slope: 70%	*Quercus chrysolepis*	1
Soil: loam	*Pinus coulteri*	+
Position:	TOTAL:	4
mid-slope	SHRUB LAYER:	
	Mimulus aurantiacus	1-2
	Toxicodendron diversilobum	1
	Lupinus albifrons	+
	TOTAL:	2
	HERB LAYER:	
	Bromus diandrus	4
	Avena barbata	2-3
	Pteridium aquilinum	1-2
	Melica imperfecta	1
	Galium aparine	1
	Quercus agrifolia	1 (seedlings)
	Phacelia ramosissima	+
	Claytonia perfoliata	+
	Pholistoma auritum	+
	Eschscholzia caespitosa	+
	Trifolium ciliolatum	+
	Pterostegia drymarioides	+
	Thysanocarpus laciniatus	+
	Sonchus oleraceus	+
	Allophyllum gilioides	+
	Lotus scoparius	+
	TOTAL:	5-6

Releve 4	Species	[1]Total Cover
El. 732 m	TREE LAYER:	
Aspect: W	*Pinus attenuata*	1
Slope: 10%	TOTAL:	1
Soil: very	SHRUB LAYER:	
rocky	*Adenostoma fasciculatum*	4
Position:	*Quercus durata*	2
upper slope	*Arctostaphylos glandulosa*	1-2
	Arctostaphylos luciana	1
	Pickeringia montana	1
	Quercus wislizenii	+
	Quercus berberidifolia	+
	Quercus aff. john-tuckeri	+
	Lotus junceus	+
	TOTAL:	5
	HERB LAYER:	
	Pedicularis densiflora	+
	TOTAL:	+

Releve 5	Species	[1]Total Cover
El. 732 m	TREE LAYER:	
Aspect: ENE	*Quercus wislizenii*	2-3
Slope: 20%	*Pinus attenuata*	2
Soil: stony	*Arbutus menziesii*	1
loam	TOTAL:	3
Position:	SHRUB LAYER:	
near	*Ceanothus papillosus*	2
ridgeline	*Sambucus mexicana*	1-2
	Arctostaphylos glandulosa	1
	Baccharis pilularis	1
	Garrya veatchii	1
	Toxicodendron diversilobum	1
	Symphoricarpos mollis	1
	TOTAL:	3
	HERB LAYER:	
	Pteridium aquilinum	2
	Lotus (strigosus?)	+
	TOTAL:	2

†Data by J. Hunter May 1994
[1]Total Cover referenced as follows: "+" =less than 1%; 1 =1-5%; 2 =5-25%; 3 =25-50%; 4 =50-75%; 5 =75-90%; 6 =95-100%

TABLE 1† (cont.) PRE-BURN RELEVES: ESTIMATED TOTAL COVER.

Releve 6 burned 1985	Species	[1]Total Cover
El. 646 m	TREE LAYER:	
Aspect: NNE	*Lithocarpus densiflorus*	3
Slope: 75%	*Pinus attenuata*	2-3
Soil: not	*Arbutus menziesii*	1
reported	*Quercus wislizenii*	1
Position:	*Quercus chrysolepis*	+
mid-slope	TOTAL:	4
	SHRUB LAYER:	
	Ceanothus oliganthus	3
	Toxicodendron diversilobum	1
	Ribes malvaceum	+
	Lonicera hispidula	+
	Mimulus aurantiacus	+
	Lupinus albifrons	+
	TOTAL:	3
	HERB LAYER:	
	Pteridium aquilinum	2
	Melica imperfecta	+
	Vulpia microstachys	+
	Claytonia perfoliata	+
	Galium aparine	+
	Trientalis latifolia	+
	Galium porrigens	+
	Cardamine oligosperma	+
	TOTAL:	2

Releve 7 (burned 1985)	Species	[1]Total Cover
El. 554 m	TREE LAYER:	
Aspect: W	*Umbellularia californica*	3
Slope: 50%	*Acer macrophyllum*	3
Soil: loamy	*Quercus agrifolia*	2
Position:	*Lithocarpus densiflorus*	1
lower slope	TOTAL:	4-5
	SHRUB LAYER:	
	Umbellularia californica	3
	Ceanothus oliganthus	1-2
	Lithocarpus densiflorus	1
	Arbutus menziesii	1
	Toxicodendron diversilobum	1
	Quercus agrifolia	+
	Marah fabaceus	+
	TOTAL:	4
	HERB LAYER:	
	Bromus diandrus	1-2
	Dryopteris arguta	1-2
	Claytonia perfoliata	1
	Galium aparine	1
	Stachys bullata	1
	Pholistoma auritum	1
	Melica imperfecta	1
	Torilis arvensis	1
	Anthriscus caucalis	1
	Symphoricarpos mollis	+
	Vicia hassei	+
	Madia gracilis	+
	Trientalis latifolia	+
	Lithophragma heterophylla	+
	Sanicula crassicaulis	+
	Pentagramma triangularis	+
	Cerastium glomeratum	+
	Cardamine oligosperma	+
	Calystegia macrostegia	+
	Elymus glaucus	+
	Sonchus oleraceus	+
	TOTAL:	3

Releve 8	Species	[1]Total Cover
El. 517 m	TREE LAYER:	
Aspect: NW	*Lithocarpus densiflorus*	2
Slope: 10%	*Umbellularia californica*	2
Soil: deep	*Arbutus menziesii*	2
Position:	*Quercus agrifolia*	2
valley	*Quercus chrysolepis*	2
bottom	*Acer macrophyllum*	1
	TOTAL:	4-5
	SHRUB LAYER:	
	Umbellularia californica	3
	Sambucus mexicana	1
	Rhamnus californica	+
	TOTAL:	3
	HERB LAYER:	
	Claytonia perfoliata	2
	Trientalis latifolia	2
	Anthriscus caucalis	2
	Dryopteris arguta	2
	Toxicodendron diversilobum	1
	Bromus diandrus	1
	Galium aparine	1
	Pteridium aquilinum	1
	Stachys bullata	1
	Cardamine oligosperma	+
	Cardamine californica	+
	Polysticum imbricans	+
	Galium porrigens	+
	Rubus ursinus	+
	Sanicula crassicaulis	+
	Osmorhiza brachypoda	+
	Urtica urens	+
	Acer macrophyllum	+
	Quercus chrysolepis	+
	Arbutus menziesii	+
	Lithocarpus densiflorus	+
	Umbellularia californica	+
	TOTAL:	3-4

[1]Data by J. Hunter May 1994
[1]Total cover referenced as follows: "+" =less than 1%; 1 =1-5%; 2 =5-25%; 3 =25-50%; 4 =50-75%; 5 =75-90%; 6 =95-100%

TABLE 1† (cont.) PRE-BURN RELEVES: ESTIMATED TOTAL COVER.

Releve 9 (unburned 1985)	**Species**	**[1]Total Cover**
El. 492 m	TREE LAYER:	
Aspect: W	*Quercus agrifolia*	3
Slope: 50%	*Quercus chrysolepis*	3
Soil: not	TOTAL:	4
reported	SHRUB LAYER:	
Position:	*Heteromeles arbutifolia*	1
lower-mid	TOTAL:	1
slope	HERB LAYER:	
	Bromus diandrus	3
	Avena barbata	1-2
	Melica imperfecta	1
	Galium aparine	1
	Vicia hassei	1
	Torilis arvensis	1
	Claytonia perfoliata	1
	Osmorhiza chilense	1
	Galium porrigens	+
	Galium andrewsii	+
	Sanicula crassicaulis	+
	Sonchus oleraceus	+
	Chlorogalum pomeridianum	+
	Lonicera hispidula	+
	Toxicodendron diversilobum	+
	Trifolium ciliolatum	+
	Madia gracilis	+
	Pterostegia drymarioides	+
	Pellaea andromedifolia	+
	Pentagramma triangularis	+
	Collinsia heterophylla	+
	TOTAL:	5

Releve 10	**Species**	**[1]Total Cover**
El. 689 m	SHRUB LAYER:	
Aspect: W	*Quercus wislizenii*	2-3
Slope: 80%	*Arctostaphylos glandulosa*	2-3
Soil: thin,	*Adenostoma fasciculatum*	1
rocky	*Dendromecon rigida*	1
Position:	*Arctostaphylos luciana*	1
upper slope	*Lotus junceus*	1
	TOTAL:	4
	HERB LAYER	
	Pedicularis densiflora	+
	TOTAL:	+

Releve 11	**Species**	**[1]Total Cover**
El. 609 m	SHRUB LAYER:	
Aspect: SSW	*Eriodictyon traskiae*	3
Slope: 60%	*Lupinus albifrons*	2-3
Soil: not	*Mimulus aurantiacus*	1
roported	TOTAL:	4
Position:	HERB LAYER:	
mid-slope	*Lamarckia aurea*	+
	Eschscholzia caespitosa	+
	Avena barbata	+
	Bromus madritensis	+
	TOTAL:	+

Releve 12	**Species**	**[1]Total Cover**
El. 609 m	TREE LAYER:	
Aspect: SSW	*Quercus agrifolia*	4
Slope: 60%	TOTAL:	4
Soil: not	SHRUB LAYER:	
roported	*Lupinus albifrons*	1-2
Position:	*Eriodictyon traskiae*	1
mid-slope	TOTAL:	2
	HERB LAYER:	
	Bromus diandrus	2
	Avena barbata	1-2
	Melica imperfecta	1
	Vulpia microstachys	1
	Lamarckia aurea	1
	Galium aparine	+
	Claytonia perfoliata	+
	Eschscholzia caespitosa	+
	Stephanomeria virgata	+
	Quercus agrifolia	+ (seedlings)
	TOTAL:	3

†Data by J. Hunter May 1994

[1]Total cover referenced as follows: "+" =less than 1%; 1 =1-5%; 2 =5-25%; 3 =25-50%; 4 =50-75%; 5 =75-90%; 6 =95-100%

TABLE 2†. POST-BURN TRANSECTS: aspect; preburn vegetation type; site slope; site burn severity; transect length. See figure 9 for transect locations.

Transect #	aspect (°)	slope	slope position	mature vegetation type (present or preburn)	burn severity: understory	burn severity: litter	transect length
Transect 1	336 (NNW)	64%	upper	mixed evergreen forest	light	moderate	50m
Transect 2	353 (NNW)	48%	middle	knobcone pine forest	light	light	50m
Transect 3	59 (ENE)	54%	top	knobcone pine forest/chaparral	moderate	light	50m
Transect 4	16 (NNE)	24%	upper	chamise chaparral	unburned	unburned	25m
Transect 5	45 (NE)	36%	top	knobcone pine forest (burned 1985)	unburned	unburned	25m
Transect 6	158-152 (SE)	60%	upper	coast live oak woodland	light	light	50m
Transect 7	16 NNE	84%	middle	coast live oak woodland/chaparral	moderate	moderate	25m
Transect 8	288 (WNW)	64%	upper	chamise chaparral	moderate	moderate	25m
Transect 9	240 (SW)	57%	upper	chaparral *(Arctostaphylos luciana)*	unburned	unburned	25m
Transect 10	198 (SSW)	77%	bottom	coast live oak woodland	scorched	light	25m
Transect 11	171 (SSE)	65%	top	chamise chaparral	moderate	moderate	25m
Transect 12	73 (ENE)	71%	bottom	mixed evergreen	scorched	scorched	25m
Transect 13	229 (SW)	81%	bottom	coast live oak woodland	unburned	unburned	25m

† Data taken by K. Phillips, A. Flinck, G. Montgomery. "Burn Severity" classification provided by K. Phillips.
Slope position: bottom=lower 20%, lower=20-40%, middle=40-60%, upper=60-80%, T=top 80%
Burn severity: heavy=mostly consumed; moderate=small stems & litter consumed; light=small twigs, foliage consumed, litter charred, scorched=foliage scorched but still present, litter partially blackened; unburned=recent fire evidence absent.

TABLE 3[†] POST-BURN SPECIES COMPOSITION and GROUND SURFACE CHARACTERISTICS. Cover values estimated from 0.5 meter point observations along a transect line 25m or 50m in length. Additional taxa = species within 1 meter wide belt along transect but not intercepted at 0.5 meter points. Density estimated from counts of individuals rooted within the 25m or 50m belt.

Transect 1 [3]**50 m**	**Taxon**	**Percent Cover**	Additional taxa	**density**[2] **#/100m²**
burned mixed evergreen forest	*Galium aparine*	13	*Lithocarpus densiflorus*	14
	Claytonia perfoliata	3	*Quercus chrysolepis*	3
	Scrophularia californica	3	*Ribes malvaceum*	3
	Lithocarpus densiflorus	3	*Dendromecon rigida*	2
	Vulpia sp.	3	*Ceanothus oliganthus*	1
	Arbutus menziesii	2	*Pinus attenuata*	1
	Dryopteris arguta	1	*Sonchus olaraceus*	1
	Lotus crassifolius	1		
	Poa howellii	1		
	Brassica nigra	1		
	Ground cover type	**Percent Cover**		
	mineral soil	48		
	litter	23		
	bare rock	16		
	gravel	11		
	log	1		
	indet. bryophyte (moss)	1		

Transect 2 [3]**50m**	**Taxon**	**Percent Cover**	Additional taxa	**density**[2] **#/100m²**
Burned knobcone pine forest	*Pteridium aquilinum*	25	*Brassica sp.*	1
	Lotus crassifolius	8	*Pinus attenuata*	9
	Vulpia sp.	7	*Quercus chrysolepis*	3
	Claytonia perfoliata	6		
	Lotus strigosus	2		
	Galium aparine	2		
	Scrophularia californica	2		
	Poa howellii	2		
	Quercus wislizenii	1		
	Lotus scoparius?	1		
	Ground cover type	**Percent Cover**		
	mineral soil	68		
	litter	24		
	gravel	4		
	bare rock	4		
	log			

Transect 3 [3]**50m**	**Taxon**	**Percent Cover**	Additional taxa	**density**[2] **#/100m²**
Burned knobcone pine forest	*Claytonia perfoliata*	9	*Arctostaphylos glandulosa*	1
	Poa howellii	4	*Pinus attenuata*	4
	Dendromecon rigida	3		
	Vulpia sp.	2		
	Lupinus albifrons	1		
	Phacelia grisea	1		
	Lotus strigosus	1		
	indet. bryophyte (moss)	1		
	Ground cover type	**Percent Cover**		
	mineral soil	68		
	bare rock	11		
	gravel	10		
	litter	6		
	burned material	4		

Transect 4 [3]**25 m**	**Taxon**	**Percent Cover**	Additional taxa	**density**[2] **#/100m²**
unburned chamise chaparral	*Pickeringia montana*	30	*Symphoricarpos mollis*	9
	Arctostaphylos glandulosa	26	*Garrya aff. veatchii*	4
	Adenostoma fasciculatum	14	*Arctostaphylos luciana*	1
	Pinus attenuata	10	*Ceanothus oliganthus*	1
	Quercus wislizenii	10		
	Symphoricarpos mollis	10		
	Cercocarpus betuloides	4		
	Ground cover type	**Percent Cover**		
	litter	66		
	mineral soil	18		
	gravel	16		

[†]Data by K. Phillips, A. Flinck, G. Montgomery, May-June 1995
[2]Density: calculated from count of individuals rooted within 1m x 25m or 1m x 50m belt as indicated.
[3]Transect length.

TABLE 3[†] (cont.); POST-BURN SPECIES COMPOSITION and GROUND SURFACE CHARACTERISTICS.

Transect 5 [3]**25m**	**Taxon**	**Percent Cover**	Additional taxa	density[2] #/100m[2]
unburned knobcone pine forest	*Pinus attenuata*	82	*Quercus wislizenii*	2
	Arctostaphylos glandulosa	20		
	Adenostoma fasciculatum	10		
	Arctostaphylos luciana	8		
	Ground cover type	**Percent Cover**		
	litter	92		
	bare rock	4		
	log	2		
	mineral soil	2		

Transect 6 [3]**25m**	**Taxon**	**Percent Cover**	Additional taxa	density[2] #/100m[2]
lightly burned coast live oak woodland	*Eriodictyon traskiae*	15	*Mimulus aurantiacus*	24
	Quercus agrifolia	7	*Dendromecon rigida*	1
	Avena barbata	4		
	Eschscholzia caespitosa	3		
	Lotus junceus	2		
	Claytonia perfoliata	2		
	Lupinus albifrons	1		
	Ground cover type	**Percent Cover**		
	mineral soil	53		
	bare rock	27		
	gravel	11		
	litter	9		

[†]Data by K. Phillips, A. Flinck, G. Montgomery, May-June 1995
[2]Density: calculated from count of individuals rooted within 1m x 25m or 1m x 50m belt as indicated.
[3]Transect length.

TABLE 3[†] (cont.); POST-BURN SPECIES COMPOSITION and GROUND SURFACE CHARACTERISTICS.

Transect 7 [3]**25m**	**Taxon**	**Percent Cover**	Additional taxa	**density**[2] **#/100m**^{2}
[3]burned mixed coast live oak woodland/ chaparral ecotone	*Phacelia distans*	24	indet. "pea"	15
	Toxicodendron diversilobum	12	*Lupinus albifrons*	9
	Calystegia macrostegia	10	*Clarkia unguiculata*	5
	Pholistoma auritum	8	*Lotus crassifolius*	4
	Quercus wislizenii	8	*Papaver californicum*	4
	Lonicera sp.	6	*Gnaphalium californicum*	4
	Cryptantha clevelandii	6	*Galium porrigens*	3
	Ceanothus oliganthus	6	*Vulpia* sp.	1
	"mustard" (*Brassica*?)	6	*Eschscholzia caespitosa*	1
	undet. "2"	4	*Emmenanthe penduliflora*	1
	Cerastium glomeratum	4	*Heteromeles arbutifolia*	1
	Claytonia perfoliata	2		
	Rubus ursinus	2		
	Mentzelia micrantha	2		
	Marah fabaceus	2		
	Ground cover type	**Percent Cover**		
	mineral soil	90		
	gravel	6		
	bare rock	4		

Transect 8 [3]**25m**	**Taxon**	**Percent Cover**	Additional taxa	**density**[2] **#/100m**^{2}
burned chamise chaparral type	*Phacelia grisea*	18	*Brassica* sp.	48
	Lupinus albifrons	14	*Pinus attenuata*	20
	Prunus ilicifolia	12	*Dendromecon rigida*	8
	Arctostaphylos glandulosa	6	*Vulpia* sp.	6
	Lotus junceus	6	*Hazardia squarrosa*	4
	Rafinesquia californica	6	*Quercus wislizenii*	4
	Phacelia distans	4	*Brickellia* sp.[5]	2
	Adenostoma fasciculatum	2	*Poa howellii*	2
	Ground cover type	**Percent Cover**	*Ceanothus oliganthus*	1
	mineral soil	52		
	gravel	30		
	bare rock	14		
	log	2		
	stick	2		

Transect 9 [3]**25m**	**Taxon**	**Percent Cover**	Additional taxa	**density**[2] **#/100m**^{2}
burned 1985 Arctostaphylos chaparral	*Arctostaphylos glandulosa*	24	----	---
	Dendromecon rigida	24		
	Arctostaphylos luciana	18		
	Quercus wislizenii	2		
	Ground cover type	**percent Cover**		
	mineral soil	48		
	gravel	24		
	litter	20		
	bare rock	8		

Transect 10 [3]**25m**	**Taxon**	**Percent Cover**	Additional taxa	**density**[2] **#/100m**^{2}
lightly burned coast live oak woodland	*Quercus agrifolia*	26	*Polygonum* sp.[6]	18
	Avena barbata	12	*Claytonia perfoliata*	12
	Pterostegia drymarioides	6	*Lathyrus vestitus*	8
	Lupinus albifrons	6	*Eschscholzia caespitosa*	7
	Phacelia grisea	6	*Lotus strigosus*	7
	Galium aparine	1	*Mimulus aurantiacus*	6
	Bromus diandrus	2	*Poa howellii*	4
	Trifolium sp.	2	*Gnaphalium californicum*	3
	Penstemon centranthifolius[4]	2	*Cryptantha clevelandii*	3
	Madia gracilis	2	***Rafinesquia californica***	**2**
	Ground cover type	**Percent Cover**	*Lotus crassifolius*	1
	mineral soil	60	*Stellaria media*	1
	gravel	18	*Sonchus oleraceus*	1
	litter	10		
	bare rock	10		
	log	2		

[†]Data by K. Phillips, A. Flinck, G. Montgomery, May-June 1995
[2]Density: calculated from count of individuals rooted within 1m x 25m or 1m x 50m belt as indicated.
[3]Transect length.
[4]Species determination unsupported by voucher specimen. Possibly *Keckiella*. See Appendix I.
[5]Brickellia determination unsupported by voucher specimen. See Appendix I.
[6]Polygonum determination unsupported by voucher specimen. See Appendix I.

TABLE 3[†] (cont.); POST-BURN SPECIES COMPOSITION and GROUND SURFACE CHARACTERISTICS.

Transect 11 [3]**25m**	**Taxon**	**Percent Cover**	Additional taxa	density[2] #/100m^2
burned Chamise chaparral type	*Adenostoma fasciculatum*	16	*Antirrhinum multiflorum*	12
	Eschscholzia caespitosa	10	*Lotus crassifolius*	9
	Lotus strigosus	8	*Rafinesquia californica*	7
	Lupinus hirsutissimus	4	*Emmenanthe penduliflora*	5
	Ceanothus sp[4]	4	*Quercus wislizenii*	5
	Ceanothus spinosus[4]	2	*Gnaphalium canescens*	3
	Silene multinervia	2	*Antirrhinum kelloggii*	3
	Lotus junceus	2	indet "pea"	2
	Lupinus albifrons	2	*Sonchus oleraceus*	1
			Lupinus bicolor	1
	Ground cover type	**Percent Cover**		
	mineral soil	70		
	gravel	18		
	litter	8		
	bare rock	4		

Transect 13 [2]**25m**	**Taxon**	**Percent Cover**	Additional taxa	density[2] #/100m^2
unburned coast live oak woodland	*Quercus agrifolia*	100	*Mimulus aurantiacus*	24
	indet "pea"[5]	30	*Acer macrophyllum*	13
	Bromus diandrus	18	*Poa howellii*	9
	Avena barbata	4	*Rafinesquia californica*	7
	Monardella villosa	2	*Pterostegia drymarioides*	3
	Galium aparine	2	*Gnaphalium californicum*	3
	Claytonia perfoliata	2	*Torilis arvensis*	2
	Ground cover type	**Percent Cover**	*Stachys bullata*	2
	litter	72	*Lotus micranthus*	1
	mineral soil	18	*Trifolium* sp.	1
	bare rock	10	*Umbellularia californica*	1
			Lupinus albifrons	1

Transect 12 [3]**25m**	**Taxon**	**Percent Cover**	Additional taxa	density[2] #/100m^2
lightly burned mixed evergreen fores forest [6]"riparian"	*Quercus chrysolepis*	58	*Madia* sp.	6
	Umbellularia californica	40	*Polypodium californicum*	4
	Acer macrophyllum	34	*Pellaea andromedifolia*	3
	Stachys bullata	12	*Thalictrum fendleri*	3
	Tauschia hartwegii	10	*Pterostegia drymarioides*	2
	Adiantum jordanii	8	*Senicula crassicaulis*	2
	Pholistoma auritum	6	*Rafinesquia californica*	1
	Galium aparine	4	*Pentagramma triangularis*	1
	Quercus agrifolia	4	*Trifolium* sp.	1
	Claytonia perfoliata	4	*Cardamine californica*	1
	Torilis arvensis	4		
	Dryopteris arguta	6		
	undet. ("broadleaved")	2		
	Bromus madritensis ssp. rubens	2		
	Bromus diandrus	2		
	Elymus glaucus	2		
	Lathyrus sp.	2		
	Ground cover type	**Percent Cover**		
	litter	62		
	mineral soil	18		
	bare rock	12		
	gravel	6		
	stick	2		

[†]Data by K. Phillips, A. Flinck, G. Montgomery, May-June 1995
[2]Density: calculated from count of individuals rooted within 1m x 25m or 1m x 50m belt as indicated.
[3]Transect length.
[4]Species determination unsupported by voucher specimen. See Appendix I.
[5]Unsupported by voucher specimen. *Vicia hassei* and *Lathyrus vestitus* are both common in the vicinity of Transect 13. See Appendix I.
[6]"Riparian" type indicates transect located near bottom of moist canyon.

TABLE 4† POST-BURN VEGETATION STRUCTURE: Numerical Values = total cover at 0.5 m vertical intervals. See figure 9 for transect locations.

Trans. No.	**T 1**	**T 2**	**T 3**	**T 4**	**T 5**	**T 6**	**T 7**	**T 8**	**T 9**	**T 10**	**T 11**	**T 12**	**T 13**
burned/ unburned	burned	burned	burned	unburned	unburned	burned	burned	burned	unburned	lightly burned	burned	lightly burned	unburned
VEGETATION TYPE (FROM TABLE 2)	mixed evergreen forest	knobcone pine forest	knobcone pine forest/ chaparral	chamise[2] chaparral	knobcone pine forest (burned 1985)	coast live oak woodland	coast live oak woodland/ chaparral	chamise[2] chaparral	Arcto. luciana[1] chaparral	coast live oak woodland	chamise[2] chaparral (also burned in 1985)	mixed evergreen forest	coast live oak woodland
DEAD STRUCTURE													
<0.5m	0.07	0.02	0.06	0.20	0.14	0.02	0	0	0.10	0	0	0	0.02
0.5-1m	0.21	0.10	0.05	0.04	0.02	0.01	0.04	0	0.04	0	0	0	0
1-1.5m	0.07	0.11	0.08	0	0	0	0	0	0	0.02	0	0	0
1.5-2m	0.04	0.11	0.14	0	0	0	0	0	0.02	0	0	0	0
>2-4m	0.05	0.14	0.11	0	0	0.02	0	0	0	0	0	0	0
>4-6m	0.01	0	0.03	0	0	0.02	0	0	0	0	0	0	0
LIVE STRUCTURE													
<0.5m	0.28	0.58	0.22	0.40	0.18	0.25	0.33	0.64	0.22	0.22	0.48	1.00	0.30
0.5-1m	0.21	0	0	0.54	0.20	0.04	0.14	0.06	0.26	0.08	0	0	0.12
1-1.5m	0	0	0	0.24	0.20	0.01	0.02	0	0.06	0.02	0	0	0
1.5-2m	0	0	0	0.12	0.40	0	0	0	0.10	0	0	0	0
>2-4m	0	0	0	0	0.64	0.01	0	0	0.18	0.04	0	0.24	0.54
>4-6m	0	0	0	0	0.08	0.01	0	0	0	0.20*	0	0.98*	0.82

†Data by K. Phillips, A. Flinck, G. Montgomery
L=live material; D=dead material (probably mostly burned, either 1985 or 1994; cause of death not specified)
1 = *Arctostaphylos luciana* dominant
2 = *Adenostoma fasciculatum* dominant
*includes trees taller than 6 meters in height

TABLE 5† DENSITY OF WOODY PLANTS WITHIN POST-BURN TRANSECTS BY TAXON AND SIZE CLASS.

Transect 1 Taxa 50 x 1 meter belt	**size class[1]**	**density[2]**
Arbutus menziesii	2	6
Ceanothus oliganthus	3	1
Dendromecon rigida	2	2
Lithocarpus densiflorus	1	1
Lithocarpus densiflorus	2	11
Lithocarpus densiflorus	3	2
Pinus attenuata	3	1
Quercus chrysolepis	2	2
Quercus chrysolepis	3	1
Ribes malvaceum	1	2
Ribes malvaceum	2	1

Transect 2 Taxa 50 x 1 meter belt	**size class[1]**	**density[2]**
Pinus attenuata	1	9
Quercus chrysolepis	2	3
Quercus wislizenii	2	6

Transect 3 Taxa 50 x 1 meter belt	**size class[1]**	**density[2]**
Arctostaphylos glandulosa	2	1
Dendromecon rigida	1	23
Dendromecon rigida	2	13
Lupinus albifrons	1	30
Pinus attenuata	1	4

Transect 4 Taxa 25 x 1 meter belt	**size class[1]**	**density[2]**
Pinus attenuata	4	3
Adenostoma fasciculatum	3	16
Arctostaphylos glandulosa	3	23
Arctostaphylos luciana	3	1
Ceanothus oliganthus	3	1
Cercocarpus betuloides	3	5
Garrya aff. veatchii	3	4
Pickeringia montana	3	38
Quercus wislizlenii	3	9
Symphoricarpos mollis	3	9

Transect 5 Taxa 25 x 1 meter belt	**size class[1]**	**density[2]**
Pinus attenuata	3+4	141
Adenostoma fasciculatum	3	7
Arctostaphylos glandulosa	3	17
Arctostaphylos luciana	3	6
Quercus wislizenii	3	2

Transect 6 Taxa 50 x 1 meter belt	**size class[1]**	**density[2]**
Dendromecon rigida	2	1
Eriodictyon traskiae	2	79
Lupinus albifrons	1	18
Mimulus aurantiacus	1	23
Mimulus aurantiacus	2	1
Quercus agrifolia	2	1
Quercus agrifolia	6	1

Transect 7 Taxa 25 x 1 meter belt	**size class[1]**	**density[2]**
Ceanothus oliganthus	1	103
Heteromeles arbutifolia	2	1
Lonicera sp. (unspecified)	1	8
Lonicera sp. (unspecified)	2	4
Lupinus albifrons	1	9
Quercus wislizenii	2	11
Rubus ursinus	2	4
Toxicodendron diversilobum	1	3
Toxicodendron diversilobum	2	35

Transect 8 Taxa 25 x 1 meter belt	**size class[1]**	**density[2]**
Arctostaphylos glandulosa	2	15
Adenostoma fasciculatum	1	58
Adenostoma fasciculatum	2	10
Ceanothus oliganthus	1	1
Dendromecon rigida	2	8
Hazardia squarrosa	2	4
Pinus attenuata	1	20
Prunus ilicifolia	1	1
Quercus wislizenii	2	4

†Data by K. Phillips, A. Flinck, G. Montgomery

[1]Size classes: 1=seedling, 2=sprout, 3=young shrub, 4=mature shrub, 5=aged shrub, 6=mature tree

[2]Density: calculated from count of individuals rooted within 1m x 25m or 1m x 50m belt as indicated.

TABLE 5† (cont.) DENSITY OF WOODY PLANTS WITHIN POST-BURN TRANSECTS BY TAXON AND SIZE CLASS.

Transect 9 Taxa 25 x 1 meter belt	**size class[1]**	**density[2]**
Arctostaphylos glandulosa	3	10
Arctostaphylos luciana	3	5
Dendromecon rigida	3	14

Transect 10 Taxa 20 x 1 meter belt	**size class[1]**	**density[2]**
Lupinus albifrons	1	57
Mimulus aurantiacus[4]	?	5
Quercus agrifolia	1	2

Transect 11 Taxa 25 x 1 meter belt	**size class[1]**	**density[2]**
Adenostoma fasciculatum	1	35
Adenostoma fasciculatum	2	57
Ceanothus oliganthus	1	2
Ceanothus spinosus[3]	1	30
Ceanothus spinosus[3]	2	28
Quercus wislizenii	2	5

Transect 12 Taxa 25 x 1 meter belt	**size class[1]**	**density[2]**
Acer macrophyllum	1	169
Quercus chrysolepis	1	6
Quercus chrysolepis	2	5

Transect 13 Taxa 25 x 1 meter belt	**size class[1]**	**density[2]**
Acer macrophyllum	1	13
Lupinus albifrons	1	1
Mimulus aurantiacus	1	20
Mimulus auranticus	2	4
Quercus agrifolia	1	6
Toxicodendron diversilobum	1	2
Toxicodendron diversilobum	2	6
Umbellularia californica	1	1

†Data by K. Phillips, A. Flinck, G. Montgomery

[1]Size classes: 1=seedling, 2=sprout, 3=young shrub, 4=mature shrub, 5=aged shrub, 6=mature tree

[2]Density: calculated from count of individuals rooted within 1m x 25m or 1m x 50m belt as indicated.

[3]Name unsupported by voucher specimen. See Appendix I.

[4]size class not reported

PLATES

Plate 1. EASTWARD VIEW FROM MT. LOWE SUMMIT. The firebreak along the ridge is clearly visible. This firebreak provides access to the RNA and defines its southern boundary (see Figure 3). The light-colored siliceous shale visible along the firebreak is habitat for *Arctostaphylos luciana*, a special-status manzanita restricted to the region within and in the immediate vicinity of the RNA.

Plate 2. 1981 NORTHEAST VIEW FROM NEAR MT. LOWE SUMMIT. Peak 3 is in the background center. This photograph was taken from the approximate site of the Plate 3, 1995 photograph, and illustrates the unburned vegetation of the Black Butte RNA. No wildfires were recorded for this area prior to 1985, although the presence of knobcone pine forest clearly indicates a long history of regular burning. Photograph taken in 1981, provided by USFS.

Plate 3. 1995 NORTHEAST VIEW FROM NEAR MT. LOWE SUMMIT. Peak 3 is in the background center. This photograph was taken from the approximate site of the Plate 2, 1981 photograph, and illustrates the extent of the recent burns within the RNA. The 1985 Las Pilitas fire burned the same region.

original color copy was taken for GTR-125 2000
5/2001

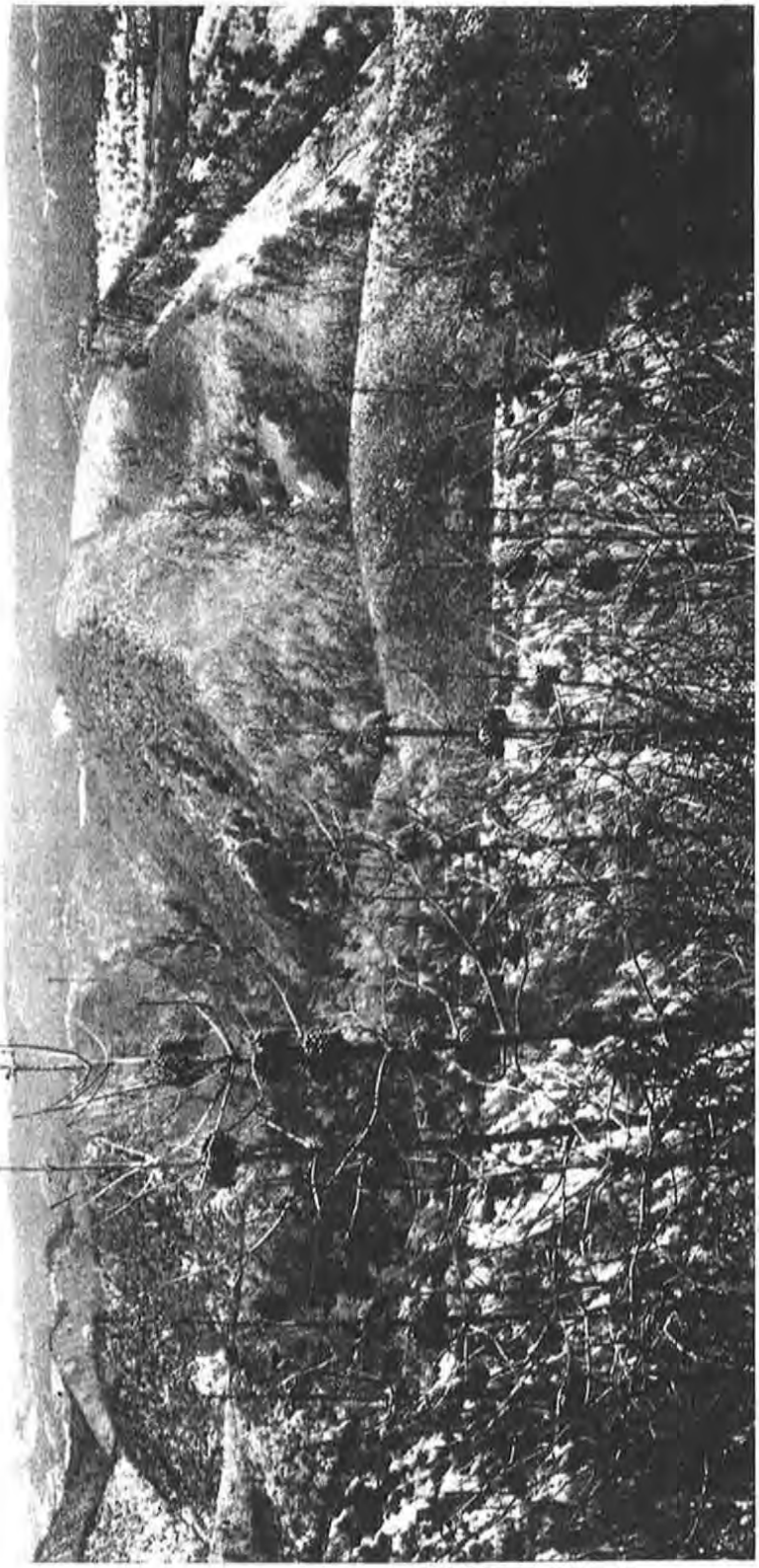


Plate 4. DEEP, CEMENTED DEPOSITION OF HILLSIDE FLOODWASH. This site is at the mouth of the canyon draining the south side of Peak and Ridge 2 (see Figure A, Appendix I). The fill is the result of erosion on burned upper and middle slopes following torrential winter cloudbursts in 1994-95. It is approximately 2 meters deep and the resulting creekbed is 2-3 times its pre-fire width. Peak 3 is to the rear. Photograph taken in April 1995.

Plate 5. DENSE POST-FIRE COVER OF *PHACELIA GRISEA* BENEATH BURNED *PINUS ATTENUATA*, *ARCTOSTAPHYLOS GLANDULOSA*. View looking northwest on southeast face of Peak 2 (see Figure A, Appendix I). Germination on burned slopes was more or less uniformly heavy in spring 1995. *Phacelia grisea* is often dominant on burned slopes within the RNA in sites previously occupied by knobcone pine and chaparral. Photograph taken in April 1995.

Plate 6. UPPER PORTION OF AN APPROXIMATELY 8-YEAR OLD *PINUS ATTENUATA* (KNOBCONE PINE). Several years' cone crops are present, indicating that *Pinus attenuata* is capable of maintaining populations in areas burned at relatively short intervals. The 1994 burn caused the lower cones to open, but was apparently not intense enough in this micro-site to open all cones. Photograph taken in April 1995.

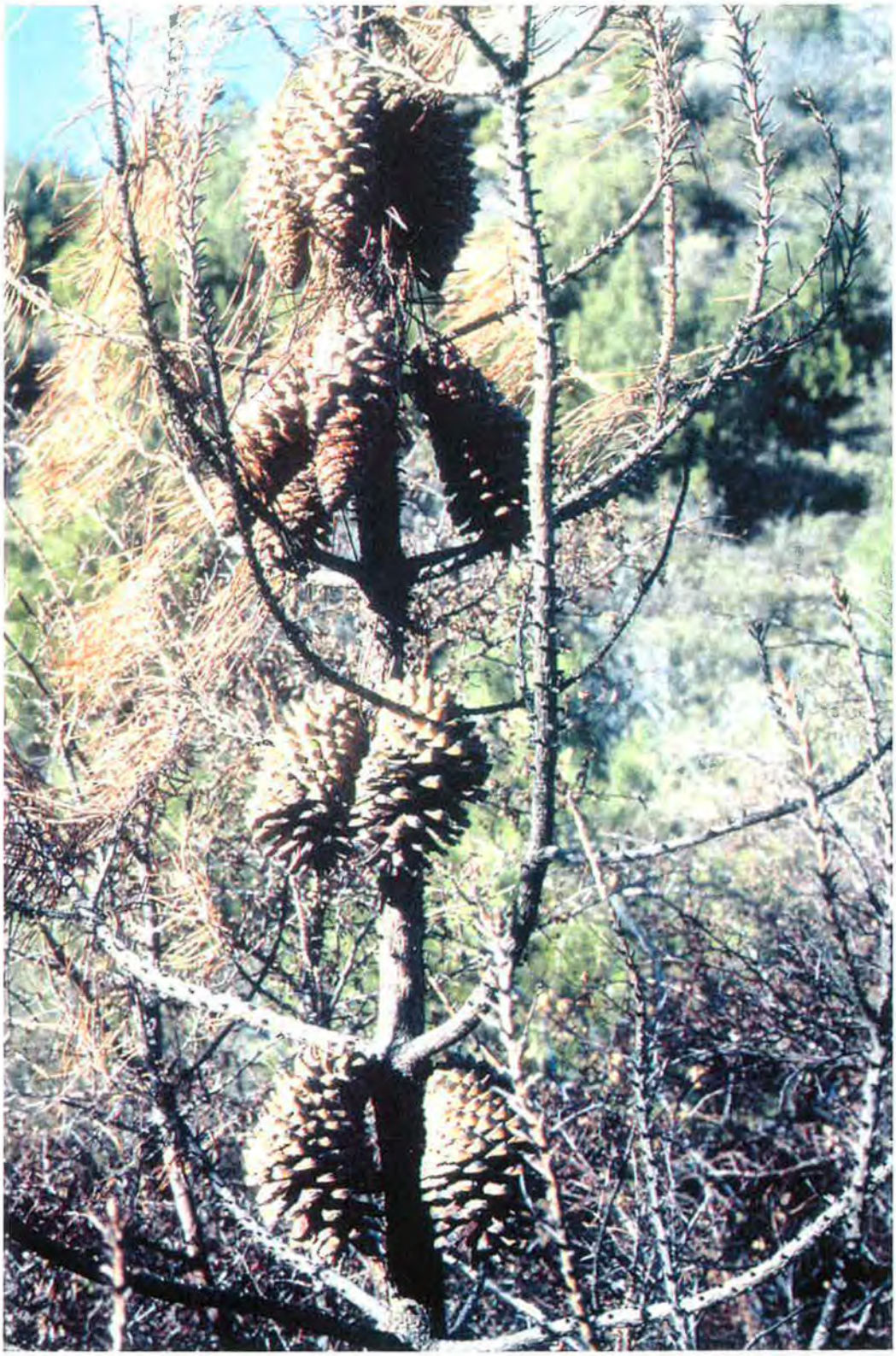


Plate 7. *ARCTOSTAPHYLOS LUCIANA* P. WELLS (SANTA LUCIA MANZANITA). This manzanita is a narrow endemic restricted to the shallow siliceous shale-derived soils on the higher ridges within and immediately adjacent to the Black Butte RNA. It is dependent upon its seed bank for reproduction. Establishment of individuals or populations generally follows burning. Photograph taken in 1982.

APPENDIX I. CATALOGUE AND KEY TO PLANT TAXA OCCURRING WITHIN THE PROPOSED BLACK BUTTE RESEARCH NATURAL AREA. Listed collection number, GFH s.n, or JH s.n indicates voucher(s) were deposited at DAV (J. M. Tucker Herbarium, UC Davis Herbaria, Section of Plant Biology, University of California, Davis). Collection numbers are those of the first author, also "GFH s.n." Specimens taken by John Hunter are designated as "JH s.n.". Species of uncertain presence or those known from BBRNA only from sterile specimens are listed at the end of the catalogue. Taxa marked with an asterisk (*) are provided in the keys, but their determinations were unconfirmed. They are likewise treated at the end of the catalogue. Place names are provided on Figure A. Nomenclature follows The Jepson Manual - Higher Plants of California (Hickman ed. 1993) except where specifically stated. Taxa without a vegetation assignment were not clearly associated with a vegetation type or were seen too rarely to be certain of their usual habitat.

SUMMARY: 207 taxa are known from the BBRNA. Four others appear likely present, and one more may occur there but for which a voucher, or reliable observation is not available. Of the 211 likely present (207 plus 4), 26 or 12.3% are species introduced to California during historical times. Although quantitative data about abundance of these introduced plants are not available, reconnaissance throughout the BBRNA indicates that few are widespread. *Torilis arvensis*, *Lamarckia aurea*, *Bromus diandrus*, and *Bromus hordeaceus* are widespread established members of the flora; the remainder of the introductions are centered about the roads in the vicinity of both Radio Facilities. While they are not likely to disappear from the BBRNA, neither are they likely to spread widely in the near future. The percentage of introduced plants is below the 18.7% reported by Hoover (1970) for San Luis Obispo County; this lack of alien species most likely reflects the absence within the BBRNA of intensive livestock grazing and the scarcity of low-elevation grassland habitats.

Hoover (op.cit.) discussed a series of genera with centers of diversity in San Luis Obispo County. These include several with one or more species in the BBRNA. They are listed here in order of richness within San Luis Obispo County; the number of San Luis Obispo County species is given in parentheses: *Lupinus* (23), *Eriogonum* (23), *Carex* (22), *Trifolium* (19), *Phacelia* (18), *Chorizanthe* (18), *Lotus* (16), *Arctostaphylos* (15), *Cryptantha* (12), and *Ceanothus* (12). Of these, *Lupinus*, *Phacelia*, and *Lotus* are well-represented at BBRNA with five species each. Of the remainder, *Trifolium* and *Cryptantha* are each represented by three species. Considering the small area encompassed by BBRNA, any genus with more than two species is probably a distinctive statistic: Noteworthy are the paucity of *Eriogonum*, *Chorizanthe*, and *Carex* in the BBRNA – each is represented here by a single species, although all three are diverse in San Luis Obispo County. The oaks (*Quercus*) are also diverse at BBRNA with eight of the eleven known from San Luis Obispo County (fide J. M. Tucker) occurring within its boundaries.

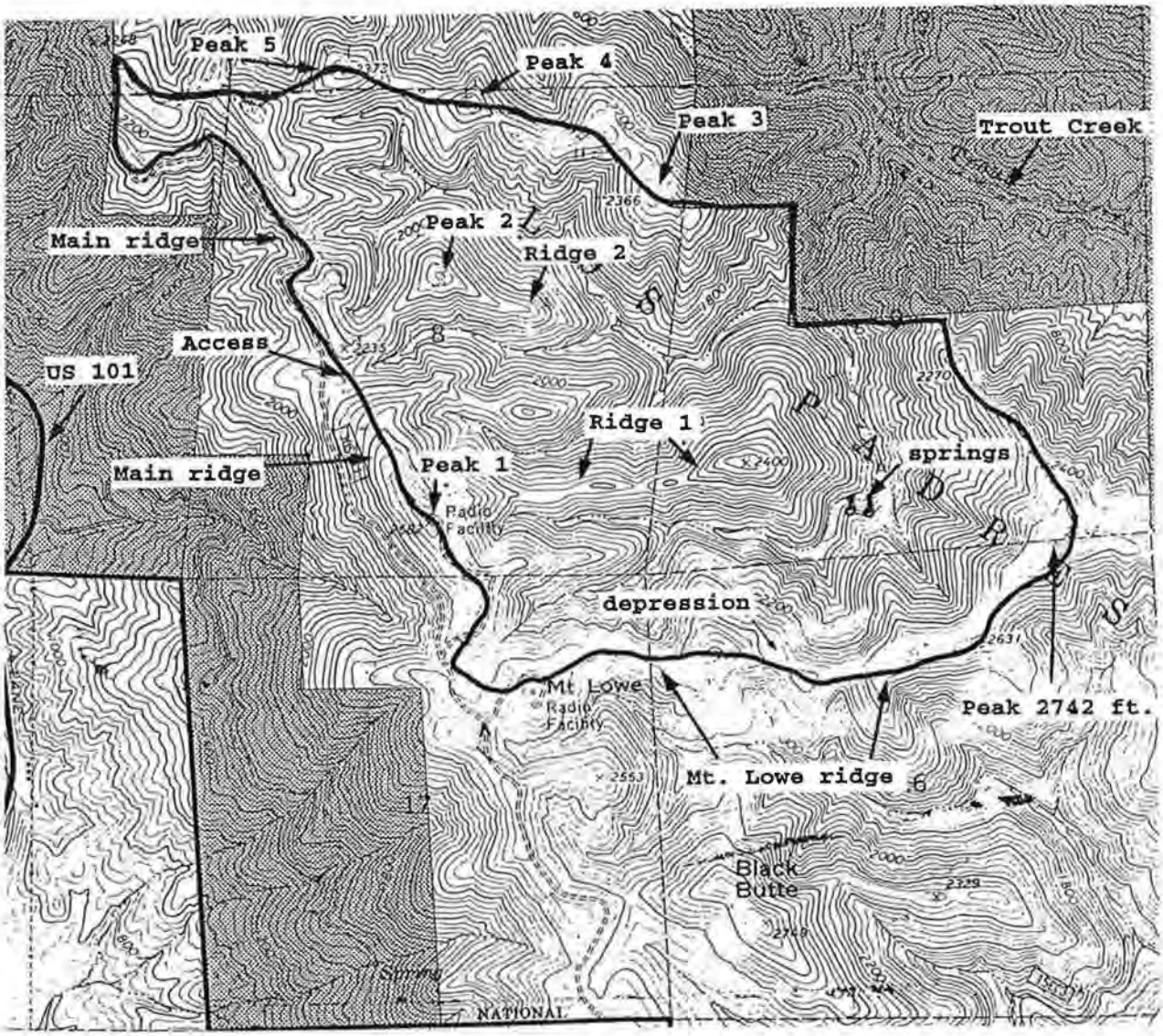


Figure A, Appendix I. LOCATIONS OF SIGNIFICANT LANDSCAPE FEATURES WITHIN THE PROPOSED BLACK BUTTE RESEARCH NATURAL AREA. These features are referenced within Appendix I and are here superimposed on the Lopez Mtn. 7.5' USGS quadrangle.

BLACK BUTTE PROPOSED RESEARCH NATURAL AREA – EAST CUESTA RIDGE
SAN LUIS OBISPO COUNTY, CALIFORNIA

CATALOGUE

Prepared by G. F. Hrusa
(with keys to genera and species)

PTEROPHYTA

Blechnaceae

Woodwardia Sm.

W. fimbriata Smith
Occasional small colonies on springs and seeps above the upper creekbanks in the main canyons. (12254), mixed evergreen forest.

Dennstaedtiaceae

Pteridium L.

P. aquilinum (L.) Kuhn ssp. ***pubescens*** L. Underw.
Widespread and common in all areas except for chaparral. Forms dense colonies on disturbed north slopes. (JH s.n.), mixed evergreen forest.

Dryopteridaceae

A. Fronds usually bipinnate, at least on part of the frond. Sori round or peltate in shape, asymmetrical, the sorus appearing "U" shaped. . . . . ***Dryopteris***
AA. Fronds once-pinnate. Indusium attached in the center, evenly covering the round sorus. . . . . ***Polystichum***

Dryopteris Adans.

D. arguta (Kaulf.) Maxon
Scattered in woodland understories, mostly in the lower canyons and on middle north slopes. (JH s.n.), mixed evergreen forest, coast live oak woodland.

Polystichum Roth

P. imbricans (D. Eaton) D. H. Wagner ssp. ***curtum*** (Ewan) D. H. Wagner
Uncommon on dry, rocky, north slopes, apparently restricted in the RNA to the north face of Mt. Lowe ridge. (12376, J.H. s.n.), mixed evergreen forest.

Polypodiaceae

Polypodium L.

P. californicum Kaulf.
On rocks, common in shaded areas, mostly in the lower canyons. (JH s.n.), mixed evergreen forest, coast live oak woodland.

Pteridaceae

A. Frond segments sclerophyllous, hard; fronds stiff, relatively inflexible. Plants often in sunny or rocky sites.
B. Frond segment margins sharply revolute, not markedly bicolored. Plants evergreen. . . . . ***Pellaea***
BB. Frond segments not sharply revolute, markedly bicolored, plants usually drying in summer. . . . . ***Pentagramma***
AA. Frond segments not sclerophyllous; soft and flexible. Plants of shady, relatively moist sites. . . . . ***Adiantum***

Adiantum L.

A. Fronds palmate-pinnate, evergreen. Plants of permanently wet sites. . . . . ***A. aleuticum***
AA. Fronds 2-3 pinnate, drying in summer. Plants of vernally wet sites. . . . . ***A. jordanii***

A. aleuticum (Rupr.) P.A. Paris
Rare. Few plants growing on a waterfall in bottom of main canyon immediately north and below Mt. Lowe. (12374), mixed evergreen forest.

A. jordanii C. Mueller
Common in shaded areas on north slopes and in bottoms of main canyons. (12245).

Pellaea Link.

P. andromedifolia (Kaulf.) Fee (JH s.n.)
Dry slopes, mostly on open shale among rocks.

Pentagramma Yatskievych

P. triangularis (Kaulf.) G. Yatskievych, M.D. Windham & E. Wollenweber
Common on dry partially shaded to shaded slopes. (JH s.n.).

CONIFEROPHYTA

Pinaceae

Pinus L.

A. Cones never more than 2 dm. in length, usually considerably shorter, the basal scale apophyses without a conspicuously elongated prickle. Needles relatively short, usually less than 1 dm. in length, bright green in color . . . . . ***P. attenuata***

AA. Cones usually at least 2-3 dm. in length, the basal scale apophyses conspicuously elongated into a curved prickle. Needles often 2-2.5 dm. in length, generally distinctly gray in color, rarely dull green, never bright green . . . . . ***P. coulteri***

P. attenuata Lemmon
Apparently associated closely with siliceous shale parent material. The largest colonies are on the Main ridge, sometimes forming dense forests on the summits and east faces, less often dominant on the west face where it tends to be scattered in chaparral. Colonies extend along all the major transverse ridges and also the east boundary ridge. Many of the trees in the RNA date from the 1985 Las Pilitas fire, and are thus only about a decade old. However, seed production has been occurring for several years before the 1994 Morro fire and seedlings were common in spring of 1995. (No voucher), knobcone pine forest, chaparral.

P. coulteri D. Don
Scattered colonies, mostly on the Main ridge but extending down Ridge 1 on its summit and upper south face. Coulter pines are scattered over Cuesta Ridge, in a number of habitats including serpentine (at the Botanical Area on the west side) and the siliceous shale present here,

but never really dominant or forming a forest overstory. The largest and best stand is northwest of the RNA, and about a mile above US 101 where it is codominant with *Quercus agrifolia*, (no voucher).

ANTHOPHYTA

DICOTYLEDONAE

Aceraceae

Acer L.

A. macrophyllum Pursh
Common in the main canyon bottoms, especially in the eastern parts. (JH s.n.), mixed evergreen forest.

Anacardiaceae

Toxicodendron Miller

T. diversilobum (Torrey & A. Gray) E. Greene
One of the most common plants in the RNA. It is not prominent on the bare siliceous shale of the Main ridge, becoming progressively more common at lower elevations and in shadier sites. Thick stands are present on some of the lower slopes above the main canyon bottoms. (No voucher), coast live oak woodland, mixed evergreen forest, chaparral.

Apiaceae

A. Mericarps with bristles, these usually distinctly hooked, plants annual or perennial.
  B. Mericarp bristles not hooked at their tips. Mericarps elongated, often 8-10x as long as wide.
    C. Mericarps each with a distinct elongated, indehiscent beak, this often as long as the body of the fruit. Plants annual. . . . . ***Anthriscus***
    CC. Mericarps elongated but without an elongated indehiscent beak. Plants perennial. . . . . ***Osmorhiza***
  BB. Mericarp bristles distinctly hooked at their tip. Mericarps no more than 2-3x as long as wide.
    C. Plants perennial, with a distinct basal rosette. Leaf divisions 1-2x as wide as long, the divisions few. Flowers yellow . . . . . ***Sanicula***
    CC. Plants annual, without distinct basal rosette. Leaf divisions relatively narrow, often 3-4x as wide as long, the divisions numerous. Flowers white . . . . . ***Torilis***
AA. Mericarps without bristles, the surface smooth, although usually with visible longitudinal striations. Plants perennial, flowers yellow. . . . . ***Tauschia***

Anthriscus Pers.

A. caucalis M. Bieb.
Shade in main canyon bottoms. Uncommon. (JH s.n.).

Osmorhiza Raf.

A. Involucel distinct, readily visible below the flower peduncle. Flowers yellowish to greenish. . . . . ***O. brachypoda***
AA. Involucel absent, or extremely reduced. Flowers white. . . . . ***O. chilense***

O. brachypoda Torrey
Shady slopes in main canyon bottoms. Uncommon. (JH s.n.), mixed evergreen forest.

O. chilense Hook. & Arn.
Shady, mostly dryish slopes in main canyons. Uncommon. (JH s.n.), mixed evergreen forest

Sanicula L.

S. crassicaulis DC.
Scattered and quite uncommon in the RNA. Largest colony is at Access (see Figure A), although it contains less than 25 individuals. Also on ridge to southwest of Peak 1. (12268), mixed evergreen forest, coast live oak woodland.

Tauschia Schldl.

T. hartwegii (A. Gray) J. F. Macbr.
Uncommon in this area. Ridge to southwest of Peak 1 and on the north slopes of Mt. Lowe ridge, the individuals never numerous. (12321), mixed evergreen forest, knobcone pine forest.

Torilis Adans.

T. arvensis (Hudson) Link
Dense colonies are in the burned understory of mixed evergreen forest and oak woodland in the lower canyons. Mostly on the lowest slopes immediately above creekbed, perhaps extending for about 30 meters or so above the canyon bottom. (12211).

Araliaceae

Aralia L.

A. californica S. Watson
Large colony on spring in bottom of canyon immediately north of Mt. Lowe ridge. Otherwise occasional individuals are on most waterfalls and in the rocky creekbeds. (12252), mixed evergreen forest.

Asteraceae

A. Heads all ligulate, ligules 5-toothed at the summit. Sap milky. Plants perennial or annual, never woody.
- B. Ligules yellow.
  - C. Inflorescence scapose, the heads solitary on elongate peduncles. Pappus of narrow scales or bristles.
    - D. Achene with an elongate beak. Plant perennial, the heads, when open often >2 cm. diameter. The summit of the peduncle immediately below the head and outer phyllaries usually clothed with ± dense white hairs. . . . . ***Agoseris***
    - DD. Achene without an elongate beak. Plant annual, capitula gen. <2 cm. diameter. The summit of the peduncle and outer phyllaries sometimes with scattered blackish hairs. . . . . ***Uropappus***
  - CC. Inflorescence not scapose. Stems below the capitula leafy or at least bracteate, the peduncles not conspicuously elongate. Pappus of copious, soft, white, capillary bristles.
    - D. Leaves with a line of stiff trichomes on the abaxial midvein surface. Fruit distinctly beaked. . . . . ***Lactuca***
    - DD. Leaves without a line of stiff trichomes on the abaxial midvein. Fruit beakless. . . . . ***Sonchus***
- BB. Ligules not yellow, white or pale pink in color.
  - C. Pappus bristles plumose.
    - D. Fruit not beaked, flowers usually pale pink, rarely appearing whitish, never with pink striations through the corolla. Plants annual or perennial . . . . . ***Stephanomeria*** (see Addendum)
    - DD. Fruit beaked, corollas usually with pink striations. Plants annual. . . . . ***Rafinesquia***
  - CC. Pappus bristles not plumose, usually barbellate.
    - D. Leaves with ± distinct white hair tufts (domatia) in the sinus. Plant annual, not hairy bristly throughout. . . . . ***Malacothrix***
    - DD. Leaves without distinct white domatia. Plant perennial, hairy-bristly throughout. . . . . ***Hieracium****

AA. Heads not all ligulate, regular 5-lobed corollas present. Marginal 3-toothed ray flowers present or absent. Sap not milky. Habit various.
- B. Capitula discoid, ray flowers absent. Plants annual, perennial or shrubby.
  - C. Disk flowers with lobes often more than 3 mm long, often one-third or more as long as the floral tube. The phyllaries ending in a sharp spine. Receptacle clothed with narrow bristles.
    - D. Flowers yellow. Tips of leaf lobes without sharp spines, or the leaves unlobed. . . . . ***Centaurea***
    - DD. Flowers pink, white, or pale pink. Tips of leaf lobes with sharp spines.

E. Leaves large, green mottled white, sap milky. . . . . ***Silybum***
EE. Leaves sometimes mottled but not large and green with distinct white mottling. Plants with clear, not milky, sap.
G. Pappus bristles barbellate or scabrous, not plumose . . . . . ***Carduus***
GG. Pappus bristles plumose . . . . . ***Cirsium***
CC. Disk flowers with lobes usually less than 1 mm in length, usually less than 1/10 the length of the floral tube.
D. Leaves decurrent on the stem, if only shortly so, then the plants annuals with linear leaves. Anthers with sagittate base. Plants annual or biennial, rarely a short-lived perennial.
E. Phyllaries scarious, papery. Leaves lanceolate to oblanceolate, not narrowly linear, gray pubescent or green and viscid. . . . . ***Gnaphalium***
EE. Phyllaries of the same texture as the leaves, densely gray pubescent. Leaves narrowly linear, also gray pubescent. . . . . ***Filago***
DD. Leaves sessile or short petioled, not decurrent. Anthers without sagittate base. Often shrubby occasionally a long-lived rhizomatous perennial, never annual or biennial.
E. Foliage odoriferous, the leaves lobed, sometimes deeply, rarely entire or nearly so, and then the plants a rhizomatous perennial with distinctly bifacial leaves, often more than 4 cm. long. . . . . ***Artemisia***
EE. Foliage not odoriferous, leaves dentate to crenate or occasionally entire, never deeply lobed, usually less than 3.5 cm. long. Plants shrubby.
F. Leaves with conspicuous sessile glands over the surface (visible at 10x), triangular ovate, petioled. Flowers dingy whitish/yellowish. . . . . ***Brickellia***
FF. Leaves without conspicuous sessile glands, the leaves obovate, mostly narrowed to the base without distinct petiols. Flowers white or yellow.
G. Flowers white in color, unisexual, the plant dioecious. The leaf toothing variable, from dentate to nearly entire, the leaves rather soft. . . . . ***Baccharis***
GG. Flowers perfect, yellow. Leaf toothing consistently dentate, the leaves rather stiff and coreaceous. . . . . ***Hazardia***
BB. Capitula with marginal ray flowers, these sometimes highly reduced and inconspicuous, the head then disciform. Plants never forming true shrubs 1 meter or more tall.
C. Leaves deeply dissected, strongly bifacial, plant subshrubby in age. . . . . ***Eriophyllum***
CC. Leaves dentate, toothed or entire, never deeply dissected, green on both surfaces. Plants herbaceous perennials or annuals, never becoming subshrubby in age.
D. Phyllaries clasping the subtending achene. Ring of bracts between innermost phyllaries and disk flowers present. Rays yellow, sometimes closing during the day. . . . . ***Madia***
DD. Phyllaries planar, not clasping the achene. Ring of bracts absent. Rays not yellow, sometimes highly reduced and the heads disciform (appearing discoid).
E. Rays conspicuous, usually >1 cm. in length, numerous, each usually at least 1 mm. in width. Plant a herbaceous perennial, subglabrous, short rhizomatous, the cauline leaves clearly amplexicaule. . . . . ***Erigeron***
EE. Rays inconspicuous, usually appearing absent. Disc. flowers whitish, sometimes with a touch of pink. The rays often with a terminal pink flush, usually <0.5 mm wide. Plant biennial or annual, conspicuously hispid, not rhizomatous. . . . . ***Conyza***

Agoseris Raf.

A. grandiflora (Benth.) E. Greene
Uncommon. In open, usually formerly disturbed sites. (JH s.n.).

Artemisia L.

A. Plant a shrub, the leaves divided into linear segments, the divisions reaching nearly to the leaf base. Foliage strongly odoriferous . . . . . ***A. californica***
AA. Plant a large rhizomatous herb, the leaves broad, the divisions wider and usually limited to the distal half of the leaf. Foliage fragrant, but not strongly odoriferous . . . . . ***A. douglasiana***

A. californica Less.
Colonies on dry slopes, mostly in the eastern part, but individuals are seen in rocky areas throughout. (JH s.n.), chaparral.

A. douglasiana Besser
Not confirmed within the RNA but likely present in lower canyon bottoms, especially in the eastern part, (no voucher).

Baccharis L.

B. pilularis DC.
Occasional in formerly disturbed areas. (No voucher), chaparral.

Carduus L.

C. pycnocephalus L.
Large colonies in understory of woodland near bottom of main canyon immediately below Ridge 2 and downstream. (12240), coast live oak woodland.

Centaurea L.

C. melitensis L.
Rare weed about road to Peak 1.

Cirsium Miller

A. Leaves not decurrent or only shortly so. The stems not appearing winged. . . . . ***C. occidentale***
AA. Leaves strongly decurrent, the stems appearing winged . . . . . ***C. vulgare***

Cirsium occidentale (Nutt.) Jepson var. ***venustum*** (E. Greene) Jepson
Scattered on dry slopes throughout. These plants are, as discussed by Hoover (1970), intermediate between the red-flowered *Cirsium* of the coastal areas and the paler purple form of the interior La Panza Range. (12258) coast live oak woodland, chaparral.

C. vulgare L.
Rare weed in more or less moist, disturbed areas. (No voucher).

Conyza Less.

C. prob. ***canadensis*** (L.) Cronq.
Rare weed in disturbed areas. (No voucher).

Erigeron L.

E. philadelphicus L.
Single patch of several plants on a rocky seep at south base of Peak 3. Immediately above the creekbed, in open grassland among oaks. (12237).

Eriophyllum Lagasca

E. confertiflorum (DC.) A. Gray
Uncommon. Occasional individuals on steep dry slopes, sometimes on bare siliceous shale. (12249), chaparral, coast live oak woodland.

Filago L.

A. Bracts subtending capitula shorter than the capitula summit. Leaves relatively wide, oblanceolate to obovate, not awl-like . . . . . ***F. californica***
AA. Bracts subtending capitula longer than the summit of the capitula. Leaves narrow, linear, awl-like . . . . . ***F. gallica***

F. californica Nutt.
Common in areas burned the year before, mostly among *Pinus attenuata*. Most common on the west end of Ridge 2 and west of Peak 2 down to the saddle. (12218), chaparral, knobcone pine forest.

F. gallica L.
Common in many disturbed areas, common mixed with *Filago californica* on the ridge and saddle of Peak 2 and Ridge 2. (12288).

Gnaphalium L.

A. Leaves green at least on upper surface, usually on both surfaces.
  B. Leaves green on both surfaces, sticky viscid. Flowers and inflorescence white . . . . . ***G. californicum***
  BB. Leaves green on the adaxial, tomentose on the abaxial surface. Flowers and phyllaries pink-tinged . . . . . ***G. ramosissimum***
AA. Leaves gray tomentose on both surfaces.
  B. Plant perennial, basal leaves present at flowering. At least the inner phyllaries with an acute tip. Capitula 5-6 mm in height . . . . . ***G. canescens***
  BB. Plant annual or biennial, basal leaves not present at flowering. The inner phyllaries with an obtuse tip. Capitula 3-4 mm in height. . . . . ***G. luteo-album***

G. canescens DC. ssp. ***beneolens*** (Davidson) Stebb. & Keil
Scattered on dry open slopes, especially common on the west face of Peak 1. (11124), chaparral, knobcone pine forest.

G. californicum DC.
Same kinds of habitats as *G. beneolens*, about as common, and often growing with it. (11120, 12319) chaparral, knobcone pine forest.

G. cf. ***ramosissimum*** Nutt.
Uncommon, known from only a single specimen. (JH s.n.).

G. luteo-album L.
Disturbed areas, and burned sites, usually among *Pinus attenuata*. Uncommon, the individuals widely scattered. (12309).

Hazardia E. Greene

H. squarrosa (Hook. & Arn.) E. Greene
Scattered individuals on dry, west and south-facing slopes. Some individuals approach *H. stenolepis* (H. M. Hall) Hoover and the plants of the RNA region were so considered by Hoover (1971); however, the majority of individuals are clearly assignable to the coastal taxon *H. squarrosus*. The habitat is clearly transitional and intermediate individuals would be expected here. (JH s.n., 12008) chaparral.

Lactuca L.

L. serriola L.
Uncommon on disturbed slopes. (Sterile voucher, GFH s.n.).

Madia Molina

A. Rays distinctly visible, capitula remaining open all day, the rays expanded. Plant perennial. . . . . ***M. madioides***
AA. Rays short and inconspicuous, capitula closing by mid-day. Plant annual. . . . . ***M. gracilis***

M. gracilis (Smith) Keck
Scattered on lower slopes, mostly in partial shade. (12248, JH s.n.) mixed evergreen forest.

M. madioides (Nutt.) E. Greene
Shady areas on slopes below Mt. Lowe. (JH s.n.) mixed evergreen forest.

Malacothrix DC.

M. floccifera (DC.) S. F. Blake
Common in burned chaparral and knobcone pine forest, especially on open, bare siliceous shale. (11131, 12300, 12364) chaparral, knobcone pine forest.

Rafinesquia Nutt.

R. californica Nutt.
Common on burned slopes, throughout the RNA, perhaps absent from shady sites and lower canyons. (12255, 12297) chaparral, knobcone pine forest.

Silybum Adans.

S. marianum (L.) Gaertner
Disturbed grassland and woodland understory in lower canyon. Rare along roadsides, (no voucher).

Sonchus L.

S. oleraceus L.
Rare weed, scattered, (no voucher).

Stephanomeria Nutt.

A. Plants perennial, silvery-canescent . . . . . ***S. cichoriacea****
AA. Plants annual, tall, upright . . . . . ***S. virgata***

S. virgata Benth. ssp. ***pleurocarpa*** (E. Greene) Gottlieb
Disturbed areas and on burned slopes. Not common. (JH s.n.)

Uropappus Nutt.

U. lindleyi (DC.) Nutt.
Uncommon. Burned west-facing slopes. (12312) knobcone pine forest, chaparral.

Boraginaceae

A. Flowers yellow to orange . . . . . ***Amsinckia***
AA. Flowers white . . . . . ***Cryptantha***

Amsinckia Lehm.

A. menziesii (Lehm.) Nelson & J. F. Macbr. ssp. ***intermedia*** (Fischer & C. Meyer) Ganders
Uncommon in woodland openings in lower canyons. (12239), coast live oak woodland.

Cryptantha Lehm. ex G. Don f.

A. Mature nutlet surface smooth, shiny. . . . . ***C. clevelandii***
AA. Nutlet surface rough, papillate, ridged, or rugose, dull; never smooth.
  B. Style tip shorter than the summit of mature nutlets. Nutlets shiny, the adaxial groove closed except at base. Flowers with usually with yellow appendages in the throat . . . . . ***C. intermedia***
  BB. Style tip exerted beyond the summit of mature nutlets. Nutlets usually dull, the adaxial groove open, especially at the base . . . . . ***C. muricata***

C. clevelandii E. Greene
Burned slopes within knobcone pine forest and sometimes in chaparral. By far the most common *Cryptantha* in the RNA. (12261, 12282, 12304), chaparral, knobcone pine forest.

C. muricata (Hook. & Arn.) Nelson & J. F. Macbr.
Uncommon on burned chaparral, and near *Pinus attenuata* on hill southwest of Peak 1. (12313), chaparral, knobcone pine forest.

C. intermedia (A. Gray) E. Greene
Understory of oak woodland on south slope of Peak 3. Not seen elsewhere. (12253), coast live oak woodland.

Brassicaceae

A. Flowers white, to cream or pale yellowish, sometimes with pink tinges, never bright yellow or orange.
  B. Fruit a silique, dehiscent
    C. Leaves simple, often deeply lobed but not compound. Petals sharply narrowed to the claw, the sepals with a narrow scarious margin . . . . . ***Guillenia***
    CC. Leaves compound, trifoliolate or greater. Petals tapered to the claw, not sharply narrowed, the sepals without a scarious margin. . . . . ***Cardamine***
  BB. Fruit an indehiscent silicle . . . . . ***Thysanocarpus***
AA. Flowers bright yellow or orange.
  B. Plant with dark to yellowish orange flowers, the petals usually at least 1 cm. in length. Foliar trichomes with two or three branches, the branches appressed. . . . . ***Erysimum***
  BB. Plant with yellow flowers. Petals usually less than 1 cm. in length. Foliar trichomes simple, not branched, or absent.
    C. Fruit with distinct indehiscent beak, usually more than 2 mm in length . . . . . ***Brassica***
    CC. Fruit without distinct indehiscent beak, or the indehiscent part much less than 2 mm . . . . . ***Sisymbrium***

Brassica L.

B. nigra (L.) Koch.
Rare weed on disturbed roadsides. (12290).

Cardamine L.

A. Plant perennial, leaflets 1-5 per leaf, petals often 1 cm. long. . . . . ***C. californica***
AA. Plant annual, leaflets 5-10 per leaf, petals usually less than 3 mm long. . . . . ***C. oligosperma***

C. californica (Torrey & A. Gray) E. Greene var. ***integrifolia*** (Torrey & A. Gray) Rollins
Dry shaded slopes mostly below Mt. Lowe on north side. The distinction between this and var. *californica* seems vague. (JH s.n.).

C. oligosperma Torrey & A. Gray
Uncommon in moist, shaded areas. (JH s.n.), mixed evergreen forest.

Erysimum L.

E. capitatum (Douglas) E. Greene
Single colony seen at east end of Ridge 1. Probably elsewhere, but not observed. (12369), coast live oak woodland.

Guillenia E. Greene

G. lasiophylla (Hook. & Arn.) E. Greene
Common in burned areas, primarily in knobcone pine forest. (12289), knobcone pine forest.

Sisymbrium L.

S. officinale L.
Rare in grassland openings among oaks in main canyon bottoms. (12247).

Thysanocarpus Hook.

T. laciniatus Torrey & A. Gray
Widely scattered in understory of oak woodland on slopes at middle elevations. (12241), coast live oak woodland.

Caprifoliaceae

A. Leaves compound, inflorescence a flat-topped compound cyme . . . . . ***Sambucus***
AA. Leaves simple, inflorescence spicate, the flowers in pairs subtended by bracts.
  B. Flowers bilateral, ± long-tubular , fruits orange to reddish . . . . . ***Lonicera***
  BB. Flowers radial, not long-tubular, fruits white . . . . . ***Symphoricarpos***

Lonicera L.

A. Plant a twining vine. Corolla pinkish-white, the tube usually more than 1 cm. in length . . . . . ***L. hispidula***
AA. Plant a shrub. Corolla cream-white, the tube usually not more than 1 cm. in length . . . . . ***L. interrupta***

L. hispidula Douglas var. ***vacillans*** A. Gray
Scattered, in canyons and on shaded slopes. (JH s.n.), mixed evergreen forest. Prostrate juvenile growth of this species is easily mistaken for *Symphoricarpos*. The leaves are more distinctly bicolored and their base more cordate in juvenile *Lonicera hispidula* than in adult or juvenile *Symphoricarpos mollis*.

L. interrupta Benth.
Uncommon on dry, west-facing slopes of Main ridge. (No voucher), chaparral.

Sambucus L.

S. mexicana C. Presl
Scattered in the canyon bottoms. (JH s.n.) mixed evergreen forest.

Symphoricarpos Duhamel

S. mollis Nutt.
Common in woodland understory. Scattered elsewhere, mostly in disturbed sites. See note under *Lonicera hispidula*. (11133), coast live oak woodland, chaparral.

Caryophyllaceae

A. Sepals fused into a distinct tube . . . . . ***Silene***
AA. Sepals free to the base.
  B. Stipules present, membranous.
    C. Styles 5, fruit valves 5. Leaves narrowly linear, clustered in the axils and appearing whorled. Flowers white to pale pink. . . . . ***Spergula***
    CC. Styles 3, fruit valves 3. Leaves narrow, subulate, somewhat fleshy, plants more or less prostrate, the leaves often clustered in the axils, but the axillary branch leaves much shorter than the primary stem leaves, and thus not appearing whorled . . . . . ***Spergularia***
  BB. Stipules absent, leaf bases sometimes joined across the node.
    C. Fruit with 10 valves, dehiscent only apically. Fruit usually curved in upper half. Styles 5 . . . . . ***Cerastium***
    CC. Fruit with 6 valves, dehiscent to the base. Styles 3 . . . . . ***Stellaria***

Cerastium L.

C. glomeratum Thuill.
Uncommon. (12212).

Silene L.

S. multinervia S. Watson
Widespread throughout all areas burned the year before. Most common around *Pinus attenuata*, also in chaparral, usually on shale but not the extremely shallow-soiled areas. (12194, 12250), chaparral, knobcone pine forest.

Spergula L.

S. arvensis L.
Rare weed. (11112, 12269).

Spergularia L.

S. rubra (L.) J. S. Presl & C. Presl
Uncommon. Disturbed areas. (12317) knobcone pine forest.

Stellaria L.

S. media (L.) Villars
Uncommon in disturbed spots in shade. Mostly seen in the main canyons. (no voucher).

Cistaceae

Helianthemum Miller

H. scoparium Nutt.
Common on dry slopes, usually among *Adenostoma* and *Arctostaphylos luciana* where openings are present among the shrubs. (11109, 12316), chaparral, knobcone pine forest.

Convolvulaceae

Calystegia R. Br.

C. macrostegia (E. Greene) Brummitt ssp. ***cyclostegia*** (House) Brummitt
Not common in the RNA, even on burned slopes. Different in frequency compared to Cuesta Ridge West serpentines where this species is dominant on recently burned slopes. The specimen cited approaches ssp. *intermedia* (Abrams) Brummitt, and may represent a northward extension of that taxon. Further study will be necessary to clarify the relationship between these two entities. (JH s.n.) mixed evergreen forest.

Cornaceae

Cornus L.

C. sericea L.
Single large colony on spring in lower canyon north of the easternmost peak on the ridge below Mt. Lowe. (GFH s.n.) mixed evergreen forest.

Crassulaceae

Dudleya Britton & Rose

A. Rosette often more than 1.5 dm. wide, densely chalky white. Leaves spatulate. Flowers dark red, pendant. . . . . ***D. pulverulenta***
AA. Rosette usually less than 1.5 dm. wide. green to brownish-gray, not chalky white. Leaves lanceolate, long-tapering to the tip. Flowers yellowish-orange to bright red, held upright. . . . . ***D. lanceolata***

D. lanceolata (Nutt.) Britton & Rose
Scattered colonies in rocky sites, mostly at higher elevations, but also in lower canyons where adequate habitat is present. (12381), chaparral.

D. pulverulenta (Nutt.) Britton & Rose
Rare in the RNA, a few individuals are on rock outcrops in the easternmost part of the main canyon. (No voucher), coast live oak woodland.

Cucurbitaceae

Marah Kellogg

M. fabaceus (Naudin) E. Greene
Mostly chaparral, but also coast live oak woodland. Occasional. (JH s.n.) mixed evergreen forest.

Cuscutaceae

Cuscuta L.

C. sp. (immature)
On annuals at Access point along 30S11 in burned site within chaparral at margin of coast live oak woodland. Probably elsewhere, but germinating late and rarely seen in the spring surveys.

Ericaceae

A. Leaves large usually greater than 0.5 dm. long, bifacial. Fruit a fleshy, granular drupe, red in color, the nutlets fused into a solid spheric stone . . . . . ***Arbutus***
AA. Leaves smaller, usually less than 4 cm in length, unifacial. Fruit mealy, dry, brown in color, the nutlets separating or partially fused, but not forming a single spheric stone . . . . . ***Arctostaphylos***

Arbutus L.

A. menziesii Pursh
Common component of the mixed evergreen association, with occasional individuals scattered in knobcone pine forest margins, and is occasional even in mesic sites adjacent to chaparral. Most common on N-facing slopes, but not restricted there. (11095, 12264) mixed evergreen forest.

Arctostaphylos Adans.

A. Plant with a lignotuber (basal burl), resprouting after fire. The leaves distinctly petioled, the bases usually tapered, not at all auriculate . . . . . ***A. glandulosa***
AA. Plant without a lignotuber, killed by fire, re-growing only from seeds. The leaves more or less sessile or the petiole short, the base auriculate, more or less clasping the stem . . . . . ***A. luciana***

A. glandulosa Eastw. var. ***cushingiana*** (Eastw.) J.E. Adams ex McMinn [f. ***cushingiana*** (Eastw.) Wells *sensu* Wells (Hickman, ed. 1993)].
The category of "forma" as an intrapopulational morph does not fit the large and consistent populations throughout central California conforming to the original description of *A. cushingiana* Eastw. There is little doubt that these burl-forming plants are closely related to *A. glandulosa* Eastw., but they appear more appropriately recognized at the varietal rank. (12223), chaparral , knobcone pine forest.

A. luciana Wells (Plate 7)
Forming large colonies along the main west-facing ridge in areas of thin soils underlain by siliceous shale. Smaller colonies and scattered individuals extend eastward along all the dissecting ridges – east at least to the first peaks on these ridges. The sessile leaves and lack of a burl easily distinguish this species from *A. glandulosa* var. *cushingiana*. Its gray foliage and relatively interior habitat stands out among its related taxa in *Arctostaphylos*. This group of non-

sprouting, sessile-leaved manzanitas is especially well-represented in San Luis Obispo County, perhaps with a center of diversity in the area from northern Santa Barbara County to near Arroyo de la Cruz. The interior habitat and gray foliage of *A. luciana* suggests an origin by hybridization with one of the local gray-foliaged *Arctostaphylos* taxa, perhaps *A. obispoensis*, *A. glauca*, or *A. pilosula*. On the other hand, red-tinted leaves in *A. obispoensis* that are similar to those of *A. luciana*, could be the result of gene flow from *A. luciana* to *A. obispoensis* and not vice-versa. (11117, 12383), chaparral, knobcone pine forest. (see Figure 10 for distribution within BBRNA).

Euphorbiaceae

Euphorbia L.

E. crenulata Engelm.
Rare in the RNA, occurring in the understory of the mixed evergreen association in the main canyon N of Mt. Lowe ridge, but never more than a plant or two in any one spot. (No voucher), mixed evergreen forest.

Fabaceae

A. Plant armed with thorns. Rhizomatous shrub with maroon-colored flowers . . . . . ***Pickeringia***
AA. Plant unarmed, not rhizomatous, flowers not maroon-colored.
  B. Flowers in elongate racemes.
    C. Leaves pinnately divided
      D. Style with hairs below the stigma, only on the inner style surface. Flowers large, pinkish-white (in ours) . . . . . ***Lathyrus***
      DD. Style with a ring of surrounding hairs below the stigma. Flowers small, white (in ours). . . . . ***Vicia***
    CC. Leaves palmately divided . . . . . ***Lupinus***
  BB. Flowers in capitate clusters, or solitary in the leaf axils.
    C. Flower clusters axillary or solitary, not terminal on long peduncles . . . . . ***Lotus***
    CC. Flower clusters terminal on long peduncles . . . . . ***Trifolium***

Lathyrus L.

L. vestitus Nutt.
Occasional, as widely scattered small colonies and apparent single individuals. Understory of coast live oak woodland and mixed evergreen forest associations; especially prominent in burned areas. (12213), mixed evergreen forest, coast live oak woodland.

Lotus L.

A. Flowers bright yellow, becoming red in age.
  B. Plants annual, low and spreading. Legume more than 10x as long as wide, many-seeded, dehiscent. . . . . ***L. strigosus***
  BB. Plants subshrubs, upright or decumbent-spreading. Legume seldom more than 4x as long as wide (excluding the beak), indehiscent.
    C. Plant many-branched from the base, the branches strongly upright. Calyx lobes at least 1/2 as long as the tube, often as long, linear-subulate in shape . . . . . ***L. scoparius***
    CC. Plant many-branched from the base, the branches spreading or decumbent, never upright except perhaps when young. Calyx lobes less than 1/2 as long as the tube, usually shorter and triangular in shape. . . . . ***L. junceus***
AA. Flowers whitish-pink to greenish-white, never distinctly bright yellow.
  B. Plant perennial. Stipules leaf-like in texture, conspicuous. Leaflets usually more than 1 cm. in width. Flowers large, usually greater than 1 cm. long . . . . . ***L. crassifolius***
  BB. Plant annual. Stipules reduced to a dot-like gland. Leaflets usually less than 0.5 cm. width. Flowers small, usually less than 0.5 cm. long. . . . . ***L. micranthus***

L. crassifolius (Benth.) E. Greene
This may be the first record from San Luis Obispo County in a generation (acc. Hoover 1970). Common as seedlings on the dissecting ridges east of the Main ridge following the 1994 fire; otherwise rare and adult plants seen only on the ridge forming the east boundary, near the south base of Peak 5. (12193), knobcone pine forest, mixed evergreen forest.

L. junceus (Benth.) E. Greene var. ***junceus*** (E. Greene) Ottley
Mostly in areas of bare siliceous shale, often associated with *Arctostaphylos luciana* and *Pinus attenuata*. Most common on the Main ridge, especially on the west face, but extending onto the higher parts of the transverse ridges also. Germinating after fire, but persisting and becoming a subdominant – especially on bare siliceous shale. Although fruiting material is currently unavailable, the short peduncles combined with the rounded calyx sinus suggests a transitional form between vars. *junceus* and *biolettii*. Hoover (1970) treats these varieties as distinct species, citing this ridge as a known site for *L. biolettii* E. Greene. The shrubs key in Hoover's local flora as he describes them (as *L. b.* var. *spiralis* Hoover). Modern treatments (Hickman ed. 1993) raise doubt as to whether the distinctions are as clear-cut as Hoover suggests, and these plants seem allied to the typical variety of *L. junceus* as treated in the above reference. More study needed here. (11114, 12296), chaparral, knobcone pine forest.

L. micranthus Benth.
Scattered individuals and small colonies, often in quite different habitats. Known from mostly burned areas, but these in both chaparral on the Main ridge and the coast live oak woodland at south base of Peak 3. (12238, 12305).

L. scoparius (Nutt.) Ottley
Although common throughout San Luis Obispo County, a single extended colony at the east end of Ridge 1 is the only known occurrence in the RNA. (12367), chaparral.

L. strigosus (Nutt.) E. Greene
Common on both bare siliceous shale and regions with better soil development, but perhaps always in areas underlain by siliceous shale. Predominant post-fire, not persisting for long afterwards. Most common on the main summit and summits of the transverse ridges to the east. (12216, 12307), chaparral, knobcone pine forest.

Lupinus L.

A. Plant a shrub, foliage distinctly silver-gray in color. . . . . ***L. albifrons***
AA. Plant an annual, foliage usually grayish-green to green in color.
  B. Plant strongly long-hairy, the hairs spreading, conspicuous.
    C. Plant with solitary flowers in the lower leaf axils. Usually strongly branched from the base, seldom more than 3 dm. tall. Plants with more or less slender stem, the hairs soft, not usually irritating. . . . . ***L. concinnus***
    CC. Plant with flowers restricted to the inflorescence. Usually strongly virgate, seldom with short branches from near the base. Plants often as much as 4-6 dm. tall. Plants with robust stem, the hairs stiff, often irritating. . . . . ***L. hirsutissimus***
  BB. Plant pubescent or glabrous, never long spreading-hairy.
    C. Flowers disposed in racemes, not at all verticillate. Plant mostly glabrous, the leaflet tips truncate, distinctly flattened across the summit. . . . . ***L. truncatus***
    CC. Flowers usually disposed in more or less distinct verticels. Plant short pubescent, the leaflet tips acute or obtuse, never truncate. . . . . ***L. bicolor***

L. albifrons Benth.
Mostly at the margin of chaparral and woodlands along the west side of the Main ridge. Occasional in burned areas in the interior of the RNA as along Ridge 2. (11129), chaparral.

L. bicolor Lindley
Scattered on burned slopes, and occasional in disturbed areas. (12302), chaparral, knobcone pine forest.

L. concinnus J. Agardh.
Widely scattered individuals and small colonies on burned sites, often on nearly bare shale. (12311), chaparral.

L. hirsutissimus Benth.
Widely scattered small colonies and individuals on open dry slopes. (12219), chaparral.

L. truncatus Hook. & Arn.
Widely scattered individuals. Usually at margin of chaparral and among *Pinus attenuata* skeletons. (12278, 12308), chaparral, knobcone pine forest.

Pickeringia Nutt. ex Torrey & A. Gray

P. montana Nutt.
Scattered colonies in chaparral areas throughout the RNA. (11119) chaparral.

Trifolium L.

A. Inflorescence with subtending involucre. Pedicels not elongating at maturity, the flowers not becoming reflexed.
  B. Involucre deeply bowl-shaped, covering at least one-half the inflorescence. Flowers pale pink. . . . . ***T. microcephalum***
  BB. Involucre rotate, not covering the inflorescence at all. Flowers dark purple, sometimes with some white. . . . . ***T. willdenovii***
AA. Subtending involucre absent. Pedicels elongating at maturity, the flowers becoming reflexed. . . . . ***T. ciliolatum***

T. ciliolatum Benth.
Uncommon. Occasional individuals are in the understory and associated openings among trees in the main canyons. (12257), mixed evergreen forest.

T. microcephalum Pursh
Burned slopes below Ridge 2. (12200), mixed evergreen forest.

T. willdenovii Sprengel
Burned open site above canyon bottom at east base of Ridge 2. (12208), mixed evergreen forest.

Vicia L.

V. hassei S. Watson
Occasional individuals at base of Ridge 2 and large colony at north base of Mt. Lowe ridge. (12210, 12222), mixed evergreen forest.

Fagaceae

A. Staminate inflorescence held ± upright, never pendant. Acorn cup with elongate, spreading scales. Leaves with strongly impressed veins visible on the upper surface . . . . . ***Lithocarpus***
AA. Staminate inflorescence pendant (catkins). Acorn cup with corky or flattened scales, the tips never spreading. Leaves with veins visible beneath, but never strongly impressed on the upper surface. . . . . ***Quercus***

Lithocarpus Blume

L. densiflorus (Hook. & Arn.) Rehder
Large colonies mostly on north-facing, higher elevation slopes. (11123), mixed evergreen forest.

Quercus L.

A. Leaves bright green, unifacial, (both sides the same bright green color).
  B. Leaves with 2-5 secondary veins. Domatia usually present on the leaf abaxial surface in the axils of the secondary veins. Leaves cupped. Acorns maturing in one season, plant a tree at maturity. . . . . ***Q. agrifolia***
  BB. Leaves with 5-12 secondary veins. Domatia absent from the abaxial surface, the leaves not usually cupped, mostly planar. Acorns maturing the second season. Plant a shrub at maturity. . . . . ***Q. wislizenii*** var. ***frutescens***
AA. Leaves gray on both surfaces, or bifacial and bright green on the adaxial surface, gray on the abaxial.
  B. Leaves distinctly bifacial. Bright or dull green on the adaxial surface and gold or gray on the abaxial. Plant a tree at maturity. . . . . ***Q. chrysolepis***
  BB. Leaves indistinctly bifacial, grayish on both surfaces, with a distinct trichome-covering on the adaxial surface.
    C. Leaves deeply lobed, deciduous, the lobes without spinose tips. Plant a tree at maturity. . . . . ***Q. lobata***
    CC. Leaves spinose toothed but not deeply lobed. Evergreen, the teeth with spinose tips. Plant a shrub at maturity.
      D. Leaves strongly revolute. . . . . ***Q. durata***
      DD. Leaves not revolute. . . . . ***Q. john-tuckeri***

Q. agrifolia Nee
The dominant tree on slopes facing south where there is good soil development. Occasionally extending well up hillsides and adjoining chaparral on the dry upper end, and mixed evergreen forest at the moist lower end. Occasionally mixed within the mixed evergreen forest association. (No voucher), coast live oak woodland, mixed evergreen forest.

Q. berberidifolia Liebm.
Scattered on dry slopes of the Main ridge, but not common. (JH s.n.) chaparral.

Q. chrysolepis Liebm.
Dominant oak species on north slopes from the higher ridges down to the lower canyons. (JH s.n.), mixed evergreen forest.

Q. durata Jepson
Rare in the RNA. Not on serpentine, which is absent from the RNA, nor on bare siliceous shale, the presence of these shrubs is unusual. They are at the edge of coast live oak woodland near Access, with several other shrubs seen only rarely: *Ceanothus papillosus*, and *Lonicera interrupta*. Fifteen years ago a tree of *Cupressus sargentii* grew along the lower side of the Main ridge road, and at the time it was assumed (by the author) that it arrived from chippings taken near the West Cuesta Botanical area and dumped here. Perhaps such is also the origin of the *Quercus durata* in this site. The leather oak shrubs escaped burning in 1994. (JH s.n.), chaparral.

Q. lobata Nee
Apparently mixed among *Quercus agrifolia* in the bottom of the main canyon. Known only from a single large branch with foliage attached found in bottom of canyon; the exact parent tree could not located. *Quercus lobata* is occasional along streams in Lopez Canyon immediately to the south. Thus its presence is not unusual here, even though the habitat appears far less than typical. (No voucher), coast live oak woodland.

Q. wislizenii A.DC. var. ***frutescens*** Engelm.
Common throughout the chaparral areas. Probably the second most common chaparral species in the RNA behind *Adenostoma fasciculatum*. (JH s.n.), chaparral, knobcone pine forest.

Q. wislizenii A. DC. aff var. ***wislizenii***
Individuals of tree size are uncommon on north slopes at higher elevations, usually in association with components of the mixed evergreen forest. Releve data reported them as occasional dominants in some sites, but high densities of this species as a tree are uncommon. It is uncertain if these are large individuals of the above variety or are a genetically different form.

Q. john-tuckeri K. Nixon & C. H. Muller
Single collection from the Main ridge appears to represent this species (acc. J.M. Tucker). *Quercus john-tuckeri* is on drier slopes in eastern San Luis Obispo County, and is common to the south in northern Santa Barbara County. This sterile collection appears slightly transitional to *Q. berberidifolia*. (JH s.n.), chaparral.

Garryaceae

Garrya Douglas ex Lindley

G. veatchii Kellogg
Based on climate, Cuesta Ridge East would be expected to support *G. veatchii*. Using Hoover's key (1970 p103), the plants of the RNA fit best that species, however, further comparison (Hickman et. al 1993) of the number of pistillate flowers/bract suggests *G. elliptica* Douglas. Leaf shape and growth habit among unburned individuals usually show the aspect of *G. veatchii* although some individuals again suggest *G. elliptica*. The problem should be examined, as clear *G. veatchii* is on serpentine on the west Cuesta Grade, while *G. elliptica* is on siliceous shale (as found in the RNA) near Montana de Oro at Los Osos. The overall variation here suggests something less than "pure" *Garrya veatchii* in the RNA. (11101 aff. ***veatchii***, 12380), chaparral.

Geraniaceae

Erodium L'Hér.

E. cicutarium (L.) L'Hér.
Weed along access road to Peak 1. (JH s.n.).

Grossulariaceae

Ribes L.

A. Nodal spines present. Flowers bright red, pendent, stamens long-exerted. . . . . ***R. speciosum***
AA. Nodal spines absent. flowers dull pink and white, stamens included . . . . . ***R. malvaceum***

R. malvaceum Sm.
Occasional in chaparral. (GFH s.n.) chaparral, coast live oak woodland.

R. speciosum Pursh
Scattered in woodland understory mostly. (JH s.n.), chaparral, coast live oak woodland.

Hydrophyllaceae

A. Shrub . . . . . ***Eriodictyon***
AA. Plant annual or a herbaceous perennial.
  B. Stamens included in the corolla.
    C. Flowers pendant. Corolla scarious, papery, persistent in fruit. Leaves simple, deeply lobed or sinuate. Flowers yellow, rarely with some pinkish tinges . . . . . ***Emmenanthe***
    CC. Corolla of normal texture, deciduous in fruit. Leaves compound, deeply lobed. Flowers white, with some purplish speckling. . . . . ***Eucrypta***
  BB. Stamens exerted from the corolla.
    C. Reflexed appendages present between the calyx lobes. Stem with small, recurved prickles (trichomes). Ovary chambers 1. . . . . ***Pholistoma***
    CC. Reflexed appendages absent. Stems variously hairy but not with stout, recurved prickles. Ovary chambers 2. . . . . ***Phacelia***

Emmenanthe Benth.

E. penduliflora Benth.
Common on burned slopes. All plants are pale yellow-flowered, no reddish colors. (12277, 12285), chaparral, knobcone pine forest.

Eriodictyon Benth.

E. traskiae Eastw.
Common in chaparral on dry open slopes. Also large colonies in burned oak woodland on south slope of Peak 2 and Ridge 2. (11111, 12224, 12320), chaparral, coast live oak woodland.

Eucrypta Nutt.

E. chrysanthemifolia (Benth.) E. Greene
Occasional on recently burned, moist, shaded slopes. (12260), knobcone pine forest, coast live oak woodland.

Phacelia Juss.

A. Flowers bright blue with white center, large, usually more than 2 cm. wide. . . . . ***P. viscida***
AA. Flowers of a single color, never bright blue, generally pale blue to white, smaller than 2 cm. diameter.
  B. At least the lower leaflets deeply divided, the divisions usually numerous, the leaves sometimes appearing bipinnate.
    C. Plant annual. Flowers shallowly campanulate, the lobes ± spreading. . . . . ***P. distans***
    CC. Plant perennial, often sprawling and rooting along the stem. Flowers narrowly campanulate, the lobes erect. . . . . ***P. ramosissima***
  BB. None of the leaflets twice-divided, or if appearing so the divisions not deep or numerous. The leaves simple or pinnate, never bipinnate.
    C. Plant annual, the leaves coarsely hispid, green to brown-purple in color. Corolla with opaque white veining and transparent interveinal regions. . . . . ***P. grisea***
    CC. Plant perennial, the leaves densely appressed canescent to strigose, greenish white in color. The corolla of a single translucence, the veins not more opaque than the remainder of the corolla tissue. . . . . ***P. imbricata***

P. distans Benth.
Scattered on burned slopes and flats. (12262, 12263, 12276), chaparral, coast live oak woodland.

P. grisea A. Gray
Forming large colonies on burned slopes occupied normally by knobcone pine forest and *Adenostoma* chaparral. Occasionally found on bare siliceous shale, but less common there than on crumbling shale with some associated topsoil. (12220, 12284, 12306), chaparral, knobcone pine forest.

P. imbricata E. Greene
Rare in the RNA. Seen only on a single rock outcrop in the bottom of the main canyon below the primary confluence. In opening of coast live oak woodland. (12231), coast live oak woodland.

P. ramosissima Lehm.
Scattered individuals in the burned understory of coast live oak woodland on the south face of Peak 3. Prostrate and rooting along the stems, with pure white flowers. These appear perennial, but heavy post-fire growth could obscure an annual habit. Provisionally assigned here because their general aspect is so different from typical *P. tanacetifolia*. Scattered individuals with pale blue flowers in slightly burned understory of coast live oak woodland in bottom of main canyon are probably the same taxon as the white-flowered plants described above. (12232, 12233), mixed evergreen forest, coast live oak woodland.

P. viscida (Benth.) Torrey
Rare in the RNA. Only found near the base of Peak 5, in burned chaparral, at a *Pinus attenuata* interface. (12192), chaparral, knobcone pine forest.

Pholistoma Lilja

P. auritum (Lindley) Lilja
Forming large colonies in the understory of burned mixed evergreen forest and coast live oak woodlands mostly on north and northeast slopes in the lower canyons. (12203), coast live oak woodland, mixed evergreen forest.

Lamiaceae

A. Flowers in a single terminal, condensed head at the summit of each branch. . . . . ***Monardella***
AA. Flowers clustered in a compound verticillate inflorescense, or solitary and axillary.
B. Stamens two, the anther sacs separated, one connective branch shorter than the other, or the anther suppressed. . . . . ***Salvia***
BB. Stamens 4, each with two anther sacs.
C. Inflorescence axillary, flowers paired or solitary. Plant from a tuber. . . . . ***Scutellaria***
CC. Inflorescence terminal, in few to many-flowered verticels. . . . . ***Stachys***

Monardella Benth.

M. villosa Benth. ssp. ***obispoensis*** (Hoover) Jokerst
Uncommon. Scattered individuals on the upper slopes, usually in areas of siliceous shale. (12366), knobcone pine forest, chaparral.

Salvia L.

A. Plant annual, flowers dark blue-purple. . . . . ***S. columbariae***
AA. Plant a herbaceous perennial or shrub. Flowers red, white or pale purple.
B. Plant a shrub. Flowers small usually less than 1 cm in length, pale purple or white. . . . . ***S. mellifera***
BB. Plant a rhizomatous perennial herb. Flowers large, usually more than 3 cm. in length, red to purplish-red. . . . . ***S. spathacea***

S. columbariae Benth. (12251) coast live oak woodland
Uncommon on burned slope on south face of Peak 3. Would be expected to form large colonies after fires, but none seen.

S. mellifera E. Greene
Observed outside the RNA and common at lower elevations and on serpentine northwest of Cuesta Pass. Not collected here prior to the 1994 fire and may not be common enough to have survived as adult plants. No seedlings seen however, and its presence in the RNA is uncertain.

S. spathacea E. Greene
Common immediately outside the RNA on the Main ridge northwest approximately 1/4 mile, and to be expected in the lower elevation east side canyons, but not yet collected or observed within the RNA proper.

Scutellaria L.

S. tuberosa Benth.
Scattered on northeast aspect on slopes above the main canyon bottoms in light shade. (12205), coast live oak woodland.

Stachys L.

A. Plants green in color, not densely tomentose. Flowers pink with some white mottling. . . . . ***S. bullata***
AA. Plants gray in color, densely tomentose. Flowers whitish. . . . . ***A. albens***

S. albens A. Gray
Single colony on spring at north base of ridge east of Mt. Lowe, (no voucher).

S. bullata Benth.
Colonies in the bottom of the main canyon at east end of Ridge 2. (12242), mixed evergreen forest, coast live oak woodland.

Lauraceae

Umbellularia Nutt.

U. californica (Hook. & Arn.) Nutt.
Common on lower slopes near canyon bottoms and more rarely on steep north-facing slopes. Mostly in southern parts of RNA. (No voucher), mixed evergreen forest.

Loasaceae

Mentzelia L.

M. micrantha (Hook. & Arn.) Torrey & A. Gray
Common on burned slopes throughout the RNA, especially in areas of chaparral, less often in knobcone pine forest, generally absent from shaded or highly fertile sites. (12197, 12275, 12298), chaparral, knobcone pine forest.

Onagraceae

A. Flowers yellow . . . . . ***Camissonia***
AA. Flowers pink or red
  B. Calyx tube elongated, often as much as 3 cm. long. Flowers red. Plant perennial, rhizomatous . . . . . ***Epilobium***
  BB. Calyx tube short, usually less than 3 mm in length. Flowers pink, the petals distinctly clawed (in ours), plant annual . . . . . ***Clarkia***

Camissonia Link

C. hirtella (E. Greene) Raven
Disturbed areas immediately southwest and below Peak 1. (12283), knobcone pine forest.

Clarkia Pursh

C. unguiculata Lindley
In vegetative characteristics varies slightly towards *C. tembloriensis*, but in pubescence of the ovary and calyx fits clearly within *C. unguiculata*. This species was collected only at the east and lowest elevation side of the RNA – where the influence of *C. tembloriensis* would be expected to be most manifest. (12243), coast live oak woodland.

Epilobium L.

E. canum (E. Greene) Raven
Rocky openings within coast live oak woodland at south base of Peak 3. Probably elsewhere, but apparently not common within the RNA, (no voucher).

Orobanchaceae

Orobanche L.

O. bulbosa G. Beck
On bare siliceous shale among *Arctostaphylos luciana*, *Adenostoma fasciculata*, and *Hazardia* aff. *squarrosa*. Not clearly associated with any of these shrubs however. (12279), chaparral, knobcone pine forest.

Paeoniaceae

Paeonia L.

P. californica Torrey & A. Gray
Woodland and chaparral understory. Uncommon. (JH s.n.), coast live oak woodland, chaparral.

Papaveraceae

A. Plant a shrub, leaves, except as seedlings, entire or serrate, never deeply lobed. . . . . ***Dendromecon***
AA. Plants annual.
B. Fruit elongate, septicidally dehiscent its entire length. Petals smooth, not crinkled. . . . . ***Eschscholzia***
BB. Fruit short, terminally dehiscent below the style base, the body not dehiscent. Petals crinkled . . . . . ***Papaver***

Dendromecon Benth.

D. rigida Benth.
Common throughout, largest colonies on Main ridge near Mt. Lowe and immediately east. (11115, 12294 seedlings), chaparral, knobcone pine forest.

Eschscholzia Cham.

E. caespitosa Benth.
Common on west facing burned sites, mainly on Main ridge, but also on the south side of Ridge 2, and scattered on Peak 3. Certainly elsewhere. (12274), chaparral, knobcone pine forest, coast live oak woodland.

Papaver L.

P. californicum A. Gray
Burned areas NW and SE of Peak 4, and few on Mt. Lowe ridge. Probably scattered in other burned areas. (12363), chaparral.

Polemoniaceae

A. Flowers pale to bright blue, ± campanulate, the throat relatively open. Leaves narrowly divided, generally becoming sharply reduced upwards, the divisions narrow. Leaves in a distinct basal rosette. . . . . ***Gilia***

AA. Flowers white or slightly tinged with lavender ± narrowly tubular the throat narrow. Stems leafy, the leaves scarcely reduced upwards, broadly divided. Basal rosette barely developed, obscure. . . . . ***Allophyllum***

Allophyllum (Nutt.) A.D. & V. Grant

A. gilioides (Benth.) A. D. Grant & V. Grant
Burned areas. Scattered, apparently mostly among *Pinus attenuata* in areas of siliceous shale. Collections of *Allophyllum* in the southern Santa Lucia Mts. have been variously interpreted as *A. glutinosum* or *A. gilioides* (see citation Hoover 1970). The plants of the RNA are apparently all a pale-flowered, long-corolla-lobed *A. gilioides*. (12259), knobcone pine forest. mixed evergreen forest.

Gilia Ruíz & Pavón

A. Flowers in dense terminal clusters, the pedicels generally <3 mm in length; the inflorescence thus capitate. . . . . ***G. achilleifolia*** sspp.
  B. Corolla usually > 1 cm. in length. The inflorescence usually >15 flowers per head, rarely fewer. . . . . ssp. ***achilleifolia***
  BB. Corolla usually < 1 cm. in length often half that. Inflorescence usually with 5 or fewer flowers per head, rarely more. . . . . ssp. ***multicaulis***
AA. Flowers disposed in an open inflorescence, the pedicels usually >1 cm. in length; the inflorescence not at all capitate. . . . . ***G. tenuiflora***

G. achilleifolia Benth.
Common on all burned areas. Usually in large contiguous colonies. Possibly associated with areas of thin soil and siliceous shale. (11102, 12293).

G. achilleifolia Benth. ssp. ***multicaulis*** (Benth.) V. Grant & A. D. Grant
Scattered individuals fit the description of this subspecies. The most recent treatment of this species complex (Hickman ed. 1993) considers that these subspecies are often sympatric. The biological reality of this intra-populational morph as a subspecies should be investigated. (12359), chaparral.

G. tenuiflora Benth. ssp. ***amplifaucalis*** A.D. Grant & V. Grant
Rare in the RNA. A single plant on Main ridge at confluence of access road to Peak 1 and Main ridge road. Bare siliceous shale. Perhaps should be considered a waif and not part of the established flora. (12270), chaparral.

Polygonaceae

A. Stipules present, membranous. Plants essentially glabrous, twining, delicate, leaves strongly spatulate, deeply cleft at the tip. . . . . ***Pterostegia***
AA. Stipules absent. Plants densely pubescent or tomentose, annual or perennial.
  B. Plant a shrub or subshrub. Flowers white . . . . . ***Eriogonum***
  BB. Plant a rosette annual. Flowers bright pink . . . . . ***Chorizanthe***

Chorizanthe R. Br. ex Benth.

C. staticoides Benth.
Uncommon. Colony along access road to Peak 1 in disturbed area, and at Access on burned or disturbed slopes. (11132, 12322), knobcone pine forest.

Eriogonum Michaux

E. elongatum Benth.
Openings on steep slopes within oak woodland. (no voucher), coast live oak woodland.

Pterostegia Fischer & C. Meyer

P. drymarioides Fischer & C. Meyer
Common on burned areas, especially in partial shade. Most common in eastern part, but essentially throughout. (12303), chaparral, knobcone pine forest, coast live oak woodland.

Portulacaceae

A. Leaves on fertile axes opposite, perfoliate. Flowers white to pale pink in color . . . . . ***Claytonia***
AA. Leaves on fertile axes alternate, sessile but not perfoliate or auriculate. Flowers generally bright, dark pink; white mutants are found occasionally (not observed in ours). . . . . ***Calandrinia***

Calandrinia Kunth

A. Calyx lobes truncate at base. Seeds minutely tuberculate . . . . . ***C. breweri***
AA. Calyx lobes rounded to cuneate at base. Seeds smooth . . . . . ***C. ciliata***

C. breweri S. Watson
Scattered in burned areas, mostly those that are rocky and supporting *Pinus attenuata*, but also elsewhere. (12195), chaparral, knobcone pine forest.

C. ciliata (Ruiz Lopez & Pavón) DC.
Scattered in burned and disturbed areas. Common along ridge southwest of Peak 1. (12196).

Claytonia L.

A. Adult (not seedling) basal leaves with narrow lamina, oblanceolate in shape, not abruptly expanded from petiole to the lamina . . . . . ***C. parviflora***
AA. Adult basal leaves with leaf abruptly expanded from petiole to the lamina . . . . . ***C. perfoliata***

C. parviflora Hook.
Common in shady, burned sites. (12235), mixed evergreen forest.

C. perfoliata Willd.
Common in shady burned sites, especially beneath *Pinus attenuata* on burned slope to SW of Peak 2. (12280), knobcone pine forest, coast live oak woodland.

Primulaceae

A. Plant with upper stem and inflorescence foreshortened, the leaves appearing whorled below a sessile umbellate inflorescence. Rootstock tuberous, plants perennial . . . . . ***Trientalis***
AA. Plant with leafy stem, the flowers solitary in the axils. Plants annual, taprooted . . . . . ***Anagallis***

Anagallis L.

A. arvensis L.
Disturbed areas southwest and below Peak 1. Uncommon. (JH s.n.).

Trientalis L.

T. latifolia Hook.
Shady woodland sites in lower parts of canyons and on wooded slopes. (JH s.n.), mixed evergreen forest.

Ranunculaceae

A. flowers perfect, showy (red in ours), with bilateral symmetry. . . . . ***Delphinium***
AA. Flowers unisexual, the plants dioecious, apetalous, with radial symmetry. . . . . ***Thalictrum***

Delphinium L.

D. cardinale Hook.
Areas of crumbling shale in lower canyons in eastern part. Reported in a similar habitat to the north near Paso Robles by Hoover, this plant is more common in southern California. The habitat here is like that described by Hoover for the Paso Robles locality, and the species probably occurs throughout the east flank of the Santa Lucia Mts. in San Luis Obispo County. (JH s.n.).

Thalictrum L.

T. fendleri A. Gray var. ***fendleri***
Single small colony along stream in lowermost drainage below ridge 2. Common along streams to the east in the Stony Creek drainage and also in the western part of the county as at Montana de Oro. (12246), mixed evergreen forest.

Rhamnaceae

A. Flowers blue or pale-blue, sometimes varying near white but distinctly colored, the calyx of the same color and texture. Fruit a dry capsule . . . . . ***Ceanothus***
AA. Flowers with white petals, or petals absent. The calyx different than the petals, green in color. Fruit a fleshy berry . . . . . ***Rhamnus***

Ceanothus L.

A. Leaves with the two lowermost secondary veins promoted to nearly the size of the main vein, the leaves appearing to have three main veins from the base reaching to near the leaf summit.
  B. Leaves green in color on both surfaces, the stems usually brownish-red in color, rarely whitish. Secondary branches seldom if ever reduced to a sharp thorn. . . . . ***C. oliganthus*** var. ***sorediatus***
  BB. Leaves ± glaucous on the upper and lower surfaces, the stems usually distinctly white colored. Secondary branches often reduced to a sharp thorn. . . . . ***C. leucodermis****
AA. Leaves with pinnate secondary venation, only the central vein reaching near the leaf summit. . . . .
  B. Leaves papillate on the upper surface. Lanceolate, the margins undulate . . . . . ***C. papillosus***
  BB. Leaves smooth on the upper surface. Ovate, the margins plane. . . . . ***C. spinosus****

C. oliganthus Nutt. var. ***sorediatus*** (Hook. & Arn.) Hoover
Common in areas marginal to mixed evergreen forest associations, mostly on higher ridges, but extending down into the main canyon below Mt. Lowe in areas of low forest cover. Uncommon in non-ridge areas. (11105, 12202), mixed evergreen forest.

C. papillosus Torrey & A. Gray
Uncommon, and seen only pre-1994 fire. Remarkably subgenus *Euceanothus* is the only one found in the RNA, although *Ceanothus cuneatus* (subgenus

Cerastes) is common in the surrounding hills west and northwest. (11107), mixed evergreen forest.

Rhamnus L.

A. Flowers bisexual, petals present although often early caducous. Fruit dark purple-blue in color. Leaves usually more than 4 cm. in length, entire or slightly crenate-margined, never spiny . . . . ***R. californica***
AA. Flowers unisexual, the plants dioecious. Petals absent. Fruit bright red in color. The leaves usually less than 3 cm. in length, spiny margined . . . . . ***R. ilicifolia***

R. californica Eschsch.
Scattered throughout. Mostly as an understory and marginal to coast live oak woodland. (11106), coast live oak woodland.

R. ilicifolia Kellogg
Dry areas in chaparral on open rocky sites, not within knobcone pine forest and uncommon on Main ridge facing west. (JH s.n.), chaparral.

Rosaceae

A. Carpels numerous, free.
  B. Leaves pinnately compound, toothed.
    C. Hypanthium shallow, the ovaries visible and not hidden within it.
      D Plant a herbaceous perennial, petals yellow, the style jointed laterally to the ovary. Fruit a dry achene. Stems hairy and glandular, but not prickly. Leaves often with as many as 8 leaflets. . . . . ***Potentilla***
      DD. Plant a scrambling woody vine, petals white, the style terminal, fruit a fleshy drupelet. . . . . ***Rubus***
    CC. Hypanthium deep, narrowed at its summit, concealing and enclosing the ovaries . . . . . ***Rosa***
  BB. Leaves simple, toothed or entire.
    C. Fruit dry, flowers small, usually less than 5 mm wide, numerous . . . . . ***Holodiscus***
    CC. Fruit compound, of fleshy drupelets. Flowers large, usually more than 3 cm. in width, few per plant. . . . . ***Rubus***
AA. Carpels solitary, or fused into a compound ovary.
    C. Ovary superior, the pistil solitary. Stamens usually more than 10.
      D. Petals absent. Style in fruit elongated, plumose. Secondary veins relatively prominent, incised. Leaf lamina planar, pubescent at least beneath . . . . . ***Cercocarpus***
      D. Petals present. Style deciduous in fruit, visible only as a scar on the fruit summit. Secondary veins visible or not but not prominent or incised.
        E. Fruit drupaceous. Inflorescence racemose, axillary. Leaves plane, sharply toothed, often more than 2 cm. in length, glabrous above and below . . . . . ***Prunus***
        EE. Fruit dry, follicular. Leaves ericoid, strongly revolute, usually less than 2 cm. in length, entire. . . . . ***Adenostoma***
    CC. Ovary compound, inferior, fruit a pome. Inflorescence cymose, stamens 10. . . . . ***Heteromeles***

Adenostoma Hook. & Arn.

A. fasciculatum Hook. & Arn.
Common throughout. Dominant in some chaparral areas, especially those away from the extreme siliceous shale along the Main ridge, but occasional in colonies there also. Dominant around Peak 4 and Peak 3. (11104), chaparral.

Cercocarpus Kunth

C. betuloides Nutt. ex Torrey & A. Gray
Uncommon shrub at ecotone between chaparral and woodland. Few plants seen, but this possibly an artifact of the recent burn (1994).

Heteromeles M. Roemer

H. arbutifolia (Lindley) Roemer
Uncommon. Essentially existing as scattered individuals in chaparral. A few plants on open rocky sites supporting chaparral at base of Peak 5 and on Ridge 2 immediately west of Peak 2. (No voucher), chaparral, knobcone pine forest.

Holodiscus (K. Koch) Maxim

H. discolor (Pursh) Maxim
Shaded understory of mixed evergreen forest association in bottom of canyon at N base of Ridge 1. Probably elsewhere, but clearly impacted by the flooding and heavy erosion post 1994 fire. (JH s.n.), mixed evergreen forest.

Potentilla L.

P. glandulosa Lindley
Uncommon in the RNA. Several individuals are in the understory of the coast live oak woodland on the S flank of Peak 3. (JH s.n.), coast live oak woodland.

Prunus L.

P. ilicifolia (Nutt.) Walp.
Scattered in chaparral, most common on rocky slopes in open type chaparral. (JH s.n.), chaparral.

Rosa L.

A. Hypanthium in fruit glabrous, the sepals deciduous . . . . . ***R. gymnocarpa***
AA. Hypanthium in fruit with numerous glandular trichomes, the sepals persistent on the hypanthium summit . . . . . ***R. spithamea***

R. gymnocarpa Nutt.
Shaded understory of mixed evergreen forest in bottom of main canyon on N side of Mt. Lowe ridge, and scattered in shady sites elsewhere. (JH s.n.), mixed evergreen forest.

R. spithamea S. Watson
Single colony in bottom of depression along main Mt. Lowe ridge within knobcone pine forest. This depression has no outlet and is perched about 0.5 km. below the east side of Mt. Lowe. (12371), knobcone pine forest.

Rubus L.

A. Leaves simple, palmately lobed. Stems without prickles. Plants forming thickets or not, the fruits reddish at maturity, seldom maturing in quantity . . . . . ***R. parviflorus***
AA. Leaves usually compound, rarely on some stems palmately lobed. Stems with prickles. Plants often forming dense scrambling thickets, the fruits dark purplish-black at maturity, seldom maturing in quantity . . . . . ***R. ursinus***

R. parviflorus Nutt.
Shaded bottom of main canyon at E base of Ridge 1 and a bit N near base of Ridge 2. (no voucher), mixed evergreen forest.

R. ursinus Cham. & Schldl.
Shaded bottom of main canyon at E base of Ridge 2. Becoming common in the area after disturbance by heavy flooding in winter of 1994-95. (JH s.n.), mixed evergreen forest, coast live oak woodland.

Rubiaceae

Galium L.

A. Foliar structures 4 per node. Plants perennial.
  B. Plants with distinct above-ground stems, slightly woody at base, usually scandent and twining in brush, rarely clumping . . . . . ***G. porrigens***
  BB. Plants tufted, the stems remaining close to the ground.
    C. Leaves narrow, linear, awl-like with a distinct sharp tip. Plants densely caespitose, tufted. Fruit glabrous. . . . . ***G. andrewsii***
    CC. Leaves wider, lanceolate to linear, not sharply bristle tipped. Fruit ± hairy. . . . . ***G. californicum***
AA. Foliar structures usually at least 6 per node, sometimes more, rarely less. Plants annual . . . . . ***G. aparine***

G. andrewsii A. Gray
Common throughout in areas of open chaparral, both on and off siliceous shale, but probably most common on the shale on west side of main face. Also at west base of Peak 2. (11098, 12226), chaparral, knobcone pine forest.

G. aparine L.
Shaded areas. (12227), coast live oak woodland.

G. californicum Hook. & Arn.
Lithocarpus forest on disturbed landslide on west face of Main ridge. Certainly still present, but not seen since 1993. (11103), mixed evergreen forest.

G. porrigens Dempster
Common throughout the RNA. (11097, 12228), coast live oak woodland, chaparral.

Salicaceae

Salix L.

S. sp.
Probably more common in canyon bottoms on east side than visible immediately post 1994-95 winter flooding. The deep filling of the bottoms of the main canyons by post-fire floodwash alluvium apparently impacted the visibility of willows. (A. Flinck s.n.(SBCC); voucher not seen) No GFH or JH voucher, presence based on personal communication from K. Phillips, USFS.

Saxifragaceae

Lithophragma Nutt.

L. heterophyllum (Hook. & Arn.) Torrey & A. Gray
Occasional in lower canyons on shaded, generally slightly disturbed hillsides. Nowhere common, but found regularly on north base of Mt. Lowe ridge. (JH s.n.), mixed evergreen forest.

Scrophulariaceae

A. Leaves opposite throughout, remaining opposite in adult plants.
  B. Staminode present, sometimes reduced and visible only by dissection.
    C. Plant annual, the flowers pale white to purplish, the lower lobe folded laterally and enclosing the style and stamens. Staminode reduced to a gland, the stamens with a basal appendage. . . . . ***Collinsia***
    CC. Plants perennial, flowers reddish-orange to maroon, the lower lobe reflexed, not enclosing the style and stamens. Stamens not appendaged.

CC. Flowers bright red or reddish-orange, >2 cm. long, the lobes more or less well-developed. Staminode nearly as long as the stamens. The leaves sessile, more or less cordate-clasping. Stems round in cross section.
D. (Ours) a scandent shrub, leaves greenish, relatively thin, margins usually more or less toothed. Flowers reddish-orange, the upper 2 lobes distinctly galeate, the lower three lobes more or less reflexed. . . . . ***Keckiella***
DD. (Ours) not shrubby, nor scandent. Occasionally slightly woody at base, usually herbaceous throughout. Leaves glaucous, bluish colored, the margins entire. Flowers bright red, long tubular, the lobes relatively short, the upper not galeate, the lower scarcely if at all reflexed. . . . . ***Penstemon****
C. Flowers dark maroon, <<2 cm. long, the lower lobes (lip) nearly obsolete. Leaves petioled. Stems generally four-sided in cross-section. . . . . ***Scrophularia***
BB. Staminode absent, stamens 4. Stigma distinctly two lipped. . . . . ***Mimulus***
AA. Leaves alternate at least above, sometimes alternate at base or in seedlings as well.
B. Leaves pinnately compound or at least divided to the midrib. . . . . ***Pedicularis***
BB. Leaves simple, sometimes lobed but not appearing compound.
C. Flowers bright orange, the subtending bracts similarly colored. Lower corolla lip reduced to a green glandlike structure, the upper lip galeate. . . . . ***Castilleja***
CC. Flowers not bright orange, blue or magenta and white. Subtending bracts not colored, of the same texture and color as the foliage. Upper and lower corolla lips alike . . . . . ***Antirrhinum***

Antirrhinum L.

A. Flower with prehensile pedicel. Flowers few, inflorescence lax. Corolla blue, plant twining, herbaceous . . . . . ***A. kelloggii***
AA. Flower with short, stout, non-prehensile pedicel. Flowers many, the inflorescence dense, spicate. Corolla magenta, white and yellow, plant subshrubby . . . . . ***A. multiflorum***

A. kelloggii E. Greene
Common on burned slopes mostly in areas of siliceous shale or nearby. (11099, 12217, 12291), chaparral, knobcone pine forest.

A. multiflorum Pennell
Disturbed areas and recently burned sites. Scattered but not uncommon. (11108, 12265), coast live oak woodland.

Castilleja Mutis ex L. f.

C. affinis Hook. & Arn.
Single plant on rock outcrop at south base of Peak 3. Opening in coast live oak woodland. (12244), coast live oak woodland.

Collinsia Nutt.

C. heterophylla Buist.
Small colony in understory and in opening of coast live oak woodland at south base of Peak 3. The flowers in this site and immediately south in Lopez Canyon are notably pale – often approaching pure white. (12236), coast live oak woodland.

Keckiella Straw

K. cordifolia (Benth.) Straw
Scattered in chaparral and oak woodland below Mt. Lowe. (JH s.n.), chaparral.

Mimulus L.

A. Plants perennial, woody or herbaceous.
B. Plants woody at base, flowers orange, sometimes buff orange or pale yellowish. Dry, sunny sites . . . . . ***M. aurantiacus***
BB. Plants wholly herbaceous, flowers bright red. Plants of wet areas . . . . . ***M. cardinalis***
AA. Plants annual.
B. Flowers bright yellow with some small reddish spots. Plants of moist, usually shaded sites, ... ***M. guttatus***
BB. Flowers magenta. Plants of dry, open, usually burned or disturbed sites . . . . . ***M. rattanii***

M. aurantiacus Curtis
Common on west side of Main ridge, and scattered elsewhere. (11118), chaparral.

M. cardinalis Benth.
Only on spring at north base of Mt. Lowe ridge. (JH s.n.), mixed evergreen forest.

M. guttatus DC.
Common on wet rock faces in bottoms of main canyons. (12234), mixed evergreen forest.

M. rattanii A. Gray
Single small colony at east base of Peak 1 where the E-facing slope first flattens out into Ridge 1. Adjacent to *Pinus coulteri* stand. On bare shale among burned chaparral shrubs and *Pinus attenuata* trees. (12373), chaparral, knobcone pine forest.

Pedicularis L.

P. densiflora Hook.
Common in many habitats. Individuals are found from densely shaded north slopes to open, nearly bare shale on south-facing sites. (JH s.n.), chaparral, knobcone pine forest, mixed evergreen forest, coast live oak woodland.

Scrophularia L.

S. californica Cham. & Schldl.
Common in the understory of burned *Pinus attenuata* stands, especially those on ridgetop flats. Normally perennial, but here acting (and looking) like an annual and flowering its first year. (12292), knobcone pine forest.

Urticaceae

Urtica L.

A. Plant perennial. Leaves usually more than 4 cm. in length, the plants often as much as 2 m tall . . . . . ***U. dioica***
AA. Plant annual. Leaves smaller, usually less than 3 cm. long, the plants usually shorter, seldom 1 m. tall . . . . . ***U. urens***

U. dioica L. ssp. ***holosericia*** (Nutt.) Thorne
Colonies on moist flats in bottom of main canyon near east end of RNA. (No voucher), mixed evergreen forest.

U. urens L.
Disturbed shady areas in main canyons, uncommon. (JH s.n.).

Verbenaceae

Verbena L.

V. lasiostachys Link
Roadside disturbed areas in lower elevation western part. Uncommon and not seen after the 1994 fire. (11096).

MONOCOTYLEDONAE

Cyperaceae

Carex L.

C. globosa Boott. (JH s.n.) mixed evergreen forest
Widely scattered small colonies in mixed evergreen forest understory.

Liliaceae

A. Perianth parts alike, sometimes in two distinct whorls but all of the same texture and color.
  B. Flowers disposed in a terminal umbel, the inflorescence scapose, leaves basal. . . . . ***Dichelostemma***
  BB. Flowers racemose, the flowering stems leafy, although these sometimes reduced.
    C. Leaves on flowering stems alternate, basal leaves present on flowering individuals, linear-lanceolate in shape, numerous.
      D. Leaves with distinctly undulating margin, ± blue-glaucous. Tepals reflexed, linear in shape. Flowers opening in evening. . . . . ***Chlorogalum***
      DD. Leaves with ± plane margin, green in color. Tepals not reflexed, triangular in shape. Flowers open during daylight. . . . . ***Zigadenus***
    CC. Leaves on flowering stems whorled. Basal leaves absent on flowering individuals. Immature or sterile individuals with a single, broad basal leaf
      D. Perianth parts >4 cm. in length, sharply reflexed, bright orange with dark spots. Plants of wet, or springy sites. . . . . ***Lilium***
      DD. Perianth parts generally <3 cm. in length, not reflexed, brownish-green, dark spotted. Plants of shaded woods and slopes, not occurring in permanently wet sites. . . . . ***Fritillaria***
AA. Perianth part unlike, the outer whorl of a different texture and color from the inner, appearing as having a distinct calyx and corolla. . . . . ***Calochortus***

Calochortus Pursh

A. Flowers white, pendant. Corolla closed. Mostly shaded areas with topsoil. . . . . ***C. albus***
AA. Flowers yellow, upright, the corolla open, bowl-shaped. Mostly sunny, rocky, exposed sites . . . . . ***C. clavatus***

C. albus Benth.
Uncommon and seen only on dry, shaded steep slopes in lower canyon at base of Ridge 2, immediately above main creekbed. (12204) mixed evergreen forest.

C. clavatus S. Watson
Single small colony on rocky flats at summit of Ridge 1. (No voucher), chaparral. (see Figure 8 for distribution within the RNA).

Dichelostemma Kunth

D. capitatum Alph. Wood.
Single small colony on rocky flats at summit of Ridge 1 and a few individuals are in depression on Mt. Lowe ridge. Sometimes treated in Alliaceae. (12372), chaparral, knobcone pine forest.

Fritillaria L.

F. affinis (Schultes) Sealy
Deeply shaded flats and adjacent slopes in canyon bottom immediately N of Ridge 1 in lower part. Several small colonies, most plants showing only vegetative growth. (No voucher), mixed evergreen forest.

Lilium L.

L. pardalinum Kellogg
Large colony on springs at north base of Mt. Lowe ridge (12368), mixed evergreen forest.

Zigadenus Michaux

Z. fremontii (Torrey) S. Watson
Single small colony on rocky flats at summit of Ridge 1. Common on Cuesta Ridge West serpentines, but rare in the RNA. (12379), chaparral.

Poaceae

A. Spikelets sessile on the rachis, often more than one per node.
  B. Spikelets solitary at the node, sessile, situated edgewise to the rachis. . . . . ***Lolium***
  BB. Some or all nodes with 2 or more spikelets.
    C. Lemmas awned, the glumes flattened, tapering to an elongated, awn-like tip. Plants with culms <1 cm. in diameter, the plants usually less than 1.5 meters tall, not densely caespitose. . . . . ***Elymus***
    CC. Lemmas not awned or the awn short. Glumes linear or subulate, sometimes tapering to a narrow tip. Plants robust, culms usually >1 cm. in diameter, the plants often 1.5 meters or more in height except in dwarfed individuals; densely caespitose . . . . . ***Leymus***
AA. Spikelets solitary, pedicellate, one per node.
  B. Spikelets dimorphic, sterile and fertile on opposite sides of the rachis, the inflorescence appearing distinctly one-sided. Plants annual, usually in open, disturbed sites. . . . . ***Lamarckia***
  BB. Spikelets all alike, all fertile. Plants annual or perennial, habitats various.
    C. Florets one per spikelet, hidden within the glumes, the spikelets usually rather small, generally less than 2 mm. in length. . . . . ***Agrostis***
    CC. Florets 2 or more per spikelet, at least the tip exposed above the top of the 2nd glume. Spikelet size various.
      D. Lemma with an awn, inserted at the summit, from a bifid tip or dorsally. The awn usually prominent, sometimes inconspicuous
        E. Lemma awned from the summit, or from a minutely bifid tip, the awn not conspicuously attached at the middle of the glume or below.
          F. Lemma awned from the summit, the tip immediately below not bifid, membranous.
            G. Plants perennial, the spikelets distinctly compressed, the inflorescence crowded and concentrated to one side of the rachis. The awns short, inconspicuous, usually <4 mm. long. . . . . ***Dactylis***
            GG. Plants annual, the spikelets not strongly compressed, the inflorescence not densely crowded and concentrated to one side of the rachis. The awns conspicuous, usually >4 mm long. . . . . ***Vulpia***
          FF. Lemmas awned from between the bifid tip, the lateral teeth usually rather membranous, of various lengths. . . . . ***Bromus***
        EE. Lemma awned from the middle of the back.
          F. Glumes > 1 cm. in length. Plants often large, coarse, more than 2 dm. tall. . . . . ***Avena***
          FF. Glumes < 1 cm. in length, usually less than 3 mm. Plants delicate, usually less than 2 dm. tall. . . . . ***Aira***
      DD. Lemmas and glumes awnless.
        E. Plants perennial, the inflorescence narrow, ± appressed to the rachis. The uppermost floret sterile, reduced to a club-shaped appendage. Leaf tip flat, not prow-shaped. Lemma base without a tuft of cobwebby hairs. . . . . ***Melica***
        EE. Plants annual (in ours as observed, but perennial species should be looked for e.g. *Poa secunda* J. S. Presl), the inflorescence various, the branches often widely spreading, occasionally appressed. Uppermost floret usually fertile, appearing similar to the lower florets. Leaf tip prow-shaped. In ours, the lemmas with a tuft of cobwebby hairs at the base. . . . . ***Poa***

Agrostis L.

A. hooveri Swallen
Single colony at west base of Peak 2 and west along the saddle to near Access. (12229), coast live oak woodland, knobcone pine forest, chaparral. (See Figure 8 for distribution within the RNA).

Aira L.

A. caryophyllea L.
Diminutive annual. Common about disturbed areas, scattered elsewhere. (No voucher).

Avena L.

A. barbata Link
Uncommon, mostly around the flat immediately north of Mt. Lowe. Introduced for slope stabilization post-1985 Las Pilitas fire? (No voucher).

Bromus L.

A. Spikelets conspicuously compressed laterally, the spikelet and florets sharply keeled on the abaxial side. . . . . ***B. carinatus***
AA. Spikelets not compressed laterally, the spikelet and florets more or less rounded on the abaxial side.
B. Awns more than 3 cm. in length . . . . . ***B. diandrus***
BB. Awns shorter than 3 cm., often much less.
C. Lemma teeth rounded at their summit, the lemma ovate to elliptic in shape. The awn usually less than 1 cm. long. Inflorescence dense to open, usually pale to gray-green rarely with any trace of anthocyanin pigments . . . . . ***B. hordeaceus***
CC. Lemma teeth pointed at the summit, the lemma lanceolate in shape. The awn often more than 1 cm. in length. Inflorescence usually dense, often with conspicuous anthocyanin pigments . . . . . ***B. madritensis*** ssp. ***rubens***

B. carinatus Hook. & Arn.
Apparently uncommon in the region of the RNA and observed only before the 1994 fire. This record is unsupported by specimen data.

B. diandrus Roth.
Accidental introduction as contaminant in seed sown for slope stabilization post-1985 Las Pilitas fire? Not common post-1994 fire, and apparently restricted to the same flat north of Mt. Lowe as are *Dactylis glomerata* and *Lolium multiflorum*. However, according to data provided by J. Hunter (see Table 5) this species was apparently more common before the 1994 fire, and was sometimes dominant in the coast live oak woodland understory (JH s.n.).

B. hordeaceus L.
Uncommon, occurring mostly around the disturbed flat immediately north of Mt. Lowe. (JH s.n.).

B. madritensis L. ssp. ***rubens*** (L.) Husnot
Common in dry areas, and along roadsides. The most common weedy grass species in the RNA. (12201).

Dactylis L.

D. glomerata L.
Uncommon, mostly around the flat immediately north of Mt. Lowe. Apparently introduced for slope stabilization post-1985 Las Pilitas fire. (12272).

Elymus L.

E. glaucus Buckley
Widely scattered throughout, disturbed roadsides or in oak woodlands, mostly at lower elevations, but likely to be encountered anywhere in the RNA. (11125), mixed evergreen forest.

Lamarckia Moench

L. aurea (L.) Moench
Widespread and common weed over most burned slopes, disturbed roadsides and roadcuts. (11113, 12286).

Leymus Hochst.

L. condensatus (C. Presl) A. Löve
Single colony at E base of Ridge 2. Probably common, but individuals widely scattered. (No voucher), mixed evergreen forest, coast live oak woodland.

Lolium L.

L. multiflorum Lam.
Uncommon weed, mostly around the flat immediately north of Mt. Lowe. Apparently introduced for slope stabilization post-1985 Las Pilitas fire. (12271).

Melica L.

M. imperfecta Trin.
Scattered in shady areas, mostly in the understory of coast live oak woodland. (12267, 12281, 12301), coast live oak woodland, knobcone pine forest.

Poa L.

P. howellii Vasey & Scribner
Common on burned slopes, mostly at higher elevations of the RNA, essentially always in open sites. Variable in plant size and openness of inflorescence. (12299, 12287, 12266, 12199, 12207, 12314), chaparral, knobcone pine forest.

Vulpia C. Gmelin

Vulpia myuros (L.) C. Gmelin (also varieties), and *V. bromoides* (L.) S. F. Gray are common in disturbed areas, but were not observed during this survey. They are included in the following key because they are likely to eventually be found here.

A. Lower inflorescence branches appressed.
  B. Glumes monomorphic, the upper and lower of ± the same length, the lower often slightly shorter than the upper.
    C. Spikelets with more than 5 florets. The spikelets substantial . . . . . ***V. octoflora***
    CC. Spikelets with 5 or fewer florets. The spikelets slender, often rather wispy . . . ***V. bromoides***
  BB. Glumes dimorphic, the lower no more than 1/2 as long as the upper, often the lower is nearly obsolete . . . . . ***V. myuros***
AA. Lower inflorescence branches spreading, the uppermost appressed. Spikelets usually with 3-5 florets . . . . . ***V. microstachys***

V. octoflora (Walter) Rydb. var. ***hirtella*** (Piper) Henrad
Burned slopes below and southwest of Peak 1. Not common. (12295), chaparral.

V. microstachys (Nutt.) Benth. var. ***pauciflora*** (Beal) Lonard & Gould
Burned slopes below and southwest of Peak 1. Common on the ridge immediately above the intersection of the Main ridge road and access road to the facility on Peak 1. In sites of bare shale, probably with little vegetation even before the 1994 fire. (12310), chaparral, knobcone pine forest.

ADDENDUM

The following records are based on sterile, solitary samples, (the resulting determinations thus uncertain), or listed from observation only. These taxa are considered possibly present, but unconfirmed.

Asteraceae

Brickellia Elliot

B. californica (Torrey & A. Gray) A. Gray
Reported (K. Phillips, A. Flinck transect data) but not supported by a specimen. The species is not listed for San Luis Obispo County by Hoover (1970) but a single shrub is known present on the sandstone hills S of Edna, (no specimen currently available but determination confirmed by the author in 1982).

Hieracium L.

indet. sp.
Immature. No other individuals seen in the RNA. According to Hoover (1970) this would be *H. argutum* Nutt. (sterile voucher JH s.n.).

Stephanomeria Nutt.

S. cichoriacea A. Gray
Rare on steep slopes. A single sterile individual observed. (Sterile voucher, GFH s.n.).

Polygonaceae

Polygonum

indet sp.
Reported during transect work (transect-10), but no specimen is available. No *Polygonum* sp(p). was observed during the floristic surveys, even on roadsides, so the identity of this report remains uncertain. The paucity of wetlands in the RNA would suggest the identity is *Polygonum arenastrum* Boreau, but this remains speculative.

Rhamnaceae

Ceanothus L.

C. spinosus Torrey and A. Gray
C. leucodermis E. Greene
A thorny *Ceanothus* was reported during transect work, and determined as *C. spinosus*. No specimen is available, and the site is in an area where *C. oliganthus* var. *sorediatus* is common. However, *C. oliganthus* var. *sorediatus* was also reported from the same transect and the two entities were considered different. Thus, this record is listed as uncertain. *C. leucodermis* would perhaps be ecologically most likely, however, the intermediate location of the study area between habitats which support *C. spinosus* and *C. leucodermis* makes the reference to either species possible.

Scrophulariaceae

Penstemon Schmidel

P. centranthifolius (Benth.) Benth.
Apparently uncommon within the study area. Reported during transect work as occurring on a steep, rocky, south-facing hillside (Transect #10 see Table 6), on southeast side of Peak 2. (no voucher). Possibly *Keckiella cordifolia*?

Liliaceae

Chlorogalum Kunth

C. pomeridianum (DC.) Kunth.
Reported but not confirmed (J. Hunter releve data). Apparently scarce, and not seen in the post-fire surveys. Common in San Luis Obispo County, and expected here.

Orchidaceae

Piperia Rydb.

P. unalascensis (Sprengel) Rydb.
Field-determined by the first author as *Habenaria unalascensis* (Sprengel) S. Watson in 1983 from bottom of main canyon below Mt. Lowe. No collection was made at that time, and this genus was not observed in the same area after the 1994 fire. Flowering in early May. The species is probably still present within the RNA.

BLACK BUTTE RESEARCH NATURAL AREA: CHECKLIST OF VASCULAR PLANTS
May 1993, 1994; April, June 1995. G.F. Hrusa, J.C. Hunter

PTEROPHYTA

BLECHNACEAE (Deer Fern Family)
Woodwardia fimbriata Sm.

DENNSTAEDTIACEAE (Bracken Family)
Pteridium aquilinum (L.) Kuhn var. *pubescens* L. Underw.

DRYOPTERIDACEAE (Wood Fern Family)
Dryopteris arguta (Kaulf.) Maxon
Polystichum imbricans (D. Eaton) D. H. Wagner ssp. *curtum* (Ewan) D. H. Wagner

POLYPODIACEAE (Polypody Family)
Polypodium californicum Kaulf.

PTERIDACEAE (Brake Fern Family)
Adiantum aleuticum (Rupr.) C.A. Paris
Adiantum jordanii Mueller
Pellaea andromedifolia (Kaulf.) Fee
Pentagramma triangularis (Kaulf.) G. Yatsk., Windham & Wollenweber

CONIFEROPHYTA

PINACEAE (Pine Family)
Pinus attenuata Lemm.
Pinus coulteri D. Don

DICOTYLEDONAE

ACERACEAE (Maple Family)
Acer macrophyllum Pursh

ANACARDIACEAE (Sumac Family)
Toxicodendron diversilobum (Torrey & A. Gray) E. Greene

APIACEAE (Carrot Family)
Anthriscus caucalis M. Bieb.
Osmorhiza brachypoda Torrey
Osmorhiza chilensis Hook. & Arn.
Sanicula crassicaulis DC.
Tauschia hartwegii (A. Gray) J.F. Macbr.
Torilis arvensis (Hudson) Link

ARALIACEAE (Ginseng Family)
Aralia californica S. Watson

ASTERACEAE (Sunflower Family)
Agoseris grandiflora (Nutt.) E. Greene
Artemisia californica Less.
Artemisia douglasiana Besser
Baccharis pilularis DC.
Brickellia californica (Torrey & A. Gray) A. Gray
Carduus pycnocephalus L.
Centaurea melitensis L.
Cirsium occidentale (Nutt.) Jepson var. *venustum* (E. Greene) Jepson
Cirsium vulgare (Savi) Ten.
Conyza cf. canadensis (L.) Cronq.
Erigeron philadelphicus L.
Eriophyllum confertiflorum (DC.) A. Gray
Filago californica Nutt.
Filago gallica L.
Gnaphalium californicum DC.

BLACK BUTTE RESEARCH NATURAL AREA: CHECKLIST OF VASCULAR PLANTS

May 1993, 1994; April, June 1995. G.F. Hrusa, J.C. Hunter

ASTERACEAE (Sunflower Family)
- *Gnaphalium canescens* DC. ssp. *beneolens* (Davidson) Stebb. & Keil
- *Gnaphalium cf. ramosissimum* Nutt.
- *Gnaphalium luteo-album* L.
- *Hazardia squarrosa* (Hook. & Arn.) E. Greene
- *Lactuca serriola* L.
- *Madia gracilis* (Smith) Keck
- *Madia madioides* (Nutt.) E. Greene
- *Malacothrix floccifera* (DC.) S.F. Blake
- *Rafinesquia californica* Nutt.
- *Silybum marianum* (L.) Gaertn.
- *Sonchus oleraceus* L.
- *Stephanomeria cichoriacea* A. Gray
- *Stephanomeria virgata* Benth. ssp. *pleurocarpa* (E. Greene) Gottlieb
- *Uropappus lindleyi* (DC.) Nutt.

BORAGINACEAE (Borage Family)
- *Amsinckia menziesii* (Lehm.) Nelson & J.F. Macbr. var. *intermedia* (Fischer & C. Meyer) Ganders
- *Cryptantha clevelandii* E. Greene
- *Cryptantha intermedia* (A. Gray) E. Greene
- *Cryptantha muricata* (Hook. & Arn.) Nelson & J. F. Macbr.

BRASSICACEAE (Mustard Family)
- *Brassica nigra* (L.) Koch
- *Cardamine californica* (Torrey & A. Gray) E. Greene var. *integrifolia* (Torrey & A. Gray) Rollins
- *Cardamine oligosperma* Torrey & A. Gray
- *Erysimum capitatum* (Douglas) E. Greene
- *Guillenia lasiophylla* (Hook. & Arn.) E. Greene
- *Sisymbrium officinale* L.
- *Thysanocarpus laciniatus* Torrey & A. Gray

CAPRIFOLIACEAE (Honeysuckle Family)
- *Lonicera hispidula* Douglas var. *vacillans* A. Gray
- *Lonicera interrupta* Benth.
- *Sambucus mexicana* C. Presl
- *Symphoricarpos mollis* Nutt.

CARYOPHYLLACEAE (Pink Family)
- *Cerastium glomeratum* Thuill.
- *Silene multinervia* S. Watson
- *Spergula arvensis* L. ssp. *arvensis*
- *Spergularia rubra* (L.) J.S. Presl & C. Presl
- *Stellaria media* (L.) Villars

CISTACEAE (Rock-Rose Family)
- *Helianthemum scoparium* Nutt.

CONVOLVULACEAE (Morning-Glory Family)
- *Calystegia macrostegia* (E. Greene) Brummitt ssp. *cyclostegia* (House) Brummitt

CORNACEAE (Dogwood Family)
- *Cornus sericea* L.

CRASSULACEAE (Stonecrop Family)
- *Dudleya lanceolata* (Nutt.) Britton & Rose
- *Dudleya pulverulenta* (Nutt.) Britton & Rose

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CUCURBITACEAE (Gourd Family)
Marah fabaceus (Naudin) E. Greene

CUSCUTACEAE (Dodder Family)
Cuscuta sp.

ERICACEAE (Heath Family)
Arbutus menziesii Pursh
Arctostaphylos glandulosa Eastw. var. *cushingiana* (Eastw.) J.E. Adams ex McMinn
Arctostaphylos luciana P.V. Wells

EUPHORBIACEAE (Spurge Family)
Euphorbia crenulata Engelm.

FABACEAE (Legume Family)
Lathyrus vestitus Nutt.
Lotus crassifolius (Benth.) E. Greene
Lotus junceus (Benth.) E. Greene var. *junceus*
Lotus micranthus Benth.
Lotus scoparius (Nutt.) Ottley
Lotus strigosus (Nutt.) E. Greene
Lupinus albifrons Benth.
Lupinus bicolor Lindley
Lupinus concinnus J. Agardh.
Lupinus hirsutissimus Benth.
Lupinus truncatus Hook. & Arn.
Pickeringia montana Nutt.
Trifolium ciliolatum Benth.
Trifolium microcephalum Pursh
Trifolium willdenovii Sprengel
Vicia hassei S. Watson

FAGACEAE (Oak Family)
Lithocarpus densiflorus (Hook. & Arn.) Rehder
Quercus agrifolia Nee
Quercus berberidifolia Liebm.
Quercus chrysolepis Liebm.
Quercus durata Jepson
Quercus john-tuckeri K. Nixon & C.H. Muller
Quercus lobata Nee
Quercus wislizenii A. DC. var. *frutescens* Engelm.
Quercus wislizenii A. DC. var. *wislizenii*

GARRYACEAE (Silk Tassel Family)
Garrya veatchii Kellogg

GERANIACEAE (Geranium Family)
Erodium cicutarium (L.) L'Hér.

GROSSULARIACEAE (Gooseberry Family)
Ribes malvaceum Sm.
Ribes speciosum Pursh

HYDROPHYLLACEAE (Waterleaf Family)
Emmenanthe penduliflora Benth.
Eriodictyon traskiae Eastw.
Eucrypta chrysanthemifolia (Benth.) E. Greene
Phacelia distans Benth.
Phacelia grisea A. Gray
Phacelia imbricata E. Greene

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HYDROPHYLLACEAE (Waterleaf Family)
Phacelia ramosissima Lehm.
Phacelia viscida (Benth.) Torrey
Pholistoma auritum (Lindley) Lilja

LAMIACEAE (Mint Family)
Monardella villosa Benth. ssp. *obipoensis* (Hoover) Jokerst
Salvia columbariae Benth.
Salvia mellifera E. Greene
Salvia spathacea E. Greene
Scutellaria tuberosa Benth.
Stachys albens A. Gray
Stachys bullata Benth.

LAURACEAE (Laurel Family)
Umbellularia californica (Hook. & Arn.) Nutt.

LOASACEAE (Loasa Family)
Mentzelia micrantha (Hook. & Arn.) Torrey & A. Gray

ONAGRACEAE (Evening Primrose Family)
Camissonia hirtella (E. Greene) Raven
Clarkia unguiculata Lindley
Epilobium canum (E. Greene) Raven

OROBANCHACEAE (Broom-rape Family)
Orobanche bulbosa G. Beck

PAEONIACEAE (Peony Family)
Paeonia californica Nutt.

PAPAVERACEAE (Poppy Family)
Dendromecon rigida Benth.
Eschscholzia caespitosa Benth.
Papaver californicum A. Gray

POLEMONIACEAE (Phlox Family)
Allophyllum gilioides (Benth.) A. D. Grant & V. Grant
Gilia achilleifolia Benth.
Gilia achilleifolia Benth. ssp. *multicaulis* (Benth.) A. D. Grant & V. Grant
Gilia tenuiflora Benth. ssp. *amplifaucalis* A.D. Grant & V. Grant

POLYGONACEAE (Buckwheat Family)
Chorizanthe staticoides Benth.
Eriogonum elongatum Benth. var. *elongatum*
Pterostegia drymarioides Fischer & C. Meyer

PORTULACACEAE (Purslane Family)
Calandrinia breweri S. Watson
Calandrinia ciliata (Ruiz Lopez & Pavon) DC.
Claytonia parviflora Hook.
Claytonia perfoliata Willd.

PRIMULACEAE (Primrose Family)
Anagallis arvensis L.
Trientalis latifolia Hook.

RANUNCULACEAE (Buttercup Family)
Delphinium cardinale Hook.
Thalictrum fendleri A. Gray var. *fendleri*

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RHAMNACEAE (Buckthorn Family)
Ceanothus oliganthus Nutt. var. *sorediatus* (Hook. & Arn.) C. Schmidt
Ceanothus papillosus Torrey & A. Gray
Rhamnus californica Eschsch.
Rhamnus ilicifolia Kellogg

ROSACEAE (Rose Family)
Adenostoma fasciculatum Hook. & Arn.
Cercocarpus betuloides Torrey & A. Gray
Heteromeles arbutifolia (Lindley) Roemer
Holodiscus discolor (Pursh) Maxim.
Potentilla glandulosa Lindley
Prunus ilicifolia (Nutt.) Walp.
Rosa gymnocarpa Nutt.
Rosa spithamea S. Watson
Rubus parviflorus Nutt.
Rubus ursinus Cham. & Schldl.

RUBIACEAE (Madder Family)
Galium andrewsii A. Gray
Galium aparine L.
Galium californicum Hook. & Arn.
Galium porrigens Dempster

SALICACEAE (Willow Family)
Salix sp.

SAXIFRAGACEAE (Saxifrage Family)
Lithophragma heterophyllum (Hook. & Arn.) Torrey & A. Gray

SCROPHULARIACEAE (Figwort Family)
Antirrhinum kelloggii E. Greene
Antirrhinum multiflorum Pennell
Keckiella cordifolia (Benth.) Straw
Mimulus aurantiacus Curtis
Mimulus cardinalis Benth.
Mimulus guttatus DC.
Mimulus rattanii A. Gray
Pedicularis densiflora Hook.
Scrophularia californica Cham. & Schldl.

URTICACEAE (Nettle Family)
Urtica dioica L. ssp. *holosericea* (Nutt.) Thorne
Urtica urens L.

VERBENACEAE (Vervain Family)
Verbena lasiostachys Link

MONOCOTYLEDONAE

CYPERACEAE (Sedge Family)
Carex globosa Boott

LILIACEAE (Lily Family)
Calochortus albus Benth.
Calochortus clavatus S. Watson
Chlorogalum pomeridianum (DC.) Kunth
Dichelostemma capitatum Alph. Wood.
Fritillaria affinis (Schultes) Sealy
Lilium pardalinum Kellogg
Zigadenus fremontii (Torrey) S. Watson

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ORCHIDACEAE (Orchid Family)
Piperia unalascensis (Sprengel) Rydb.

POACEAE (Grass Family)
Agrostis hooveri Swallen
Aira caryophyllea L.
Avena barbata Link
Bromus carinatus Hook. & Arn.
Bromus diandrus Roth
Bromus hordeaceus L.
Bromus madritensis L. ssp. *rubens* (L.) Husnot
Dactylis glomerata L.
Elymus glaucus Buckley
Lamarckia aurea (L.) Moench
Leymus condensatus (C. Presl) A. Love
Lolium multiflorum Lam.
Melica imperfecta Trin.
Poa howellii Vasey & Scribner
Vulpia microstachys (Nutt.) Benth. var. *pauciflora* (Beal) Lonard & Gould
Vulpia octoflora (Walter) Rydb. var. *hirtella* (Piper) Henrad